CHEMISTRY

BOOKS - CENGAGE CHEMISTRY (HINGLISH)

COORDINATION COMPOUNDS

Illustration

1. Why NH_3 form coordinate complex, while the isoelectronic species CH_4 does not .

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2. Calculate the oxidation number of Ni ion $\left[Ni\left(H_2O_6\right)_6\right]^{2+}\right]$.

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3. Calculate the oxidation number of Ni in $K_2[Ni(CN)_4]$.

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4. What is the coordination number and oxidation state of Al in the complex $\left[AI\left(H_2O\right)_4(OH)_2\right]^{\oplus}$? .

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5. In the complex $\left[Fe\left(H_2O\right)_5CI\right]Br$, identify

(a) Ligands and their charges

(b) Charge of the central ion in the complex

(c) What-would happen if Ag NO_3 is added to the compound at $0^{\circ}C$

.

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6. Write the formula for the following coordination compounds

(a) Tetraamineaquachlorido cobat (III) chloride

(b) Postassium tetrahydroxozincate (II)

(c) Potassium trioxalatoaluminate (III)

(d) Dichloridobis (ethane 1, 2 -diamine)cabalt (III) ion

(e) Tetracarbonylnicked (0)

(II) Write $IUPA$ names of the following coordination compounds

(a) $\left[Pt\left(NH_{3\,-}\,(2)CI\left(NO_2\right)\right]\right.$ (b) $K_3\left[Cr\left(C_2O_4\right)_3\right]$

(c) $\left[CoCi_2(en)_2\right]CI$ (d) $\left[Co\left(NH_3\right)\left(CO_3\right)C1\right.$

(e) $Hg\left[Co(SCN)_4\right)\right]$.

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7. Write the formula for the following coordination compounds

(a) Tetrahydroxozincate (II) chloride

(b) Pentaaquachloridochromium (II) chloride

(c) Tetrabromidocuprate (II) ion

(d) Pentacarbony1 iron (0)

(e) Potassium tetracyanocuprate(II)

(f) Tetraamminediaquanickel (II) sulphate

(g) Tetraaquadichloridoiron (III) ion

(h) Potassium trioxalatochromate

(i) Pentachloridoazidoosmiate (VI) ion

(j)Triaquachloridoplatinum (II) bromide .

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8. Name of the following complex ions

(a) $\left[PdBr_4\right]^{2-}(b)\left[CuCI_2\right]^{\oplus}$

$(c)\left[Au(CN)_4\right]^{\oplus}(d)\left[AIF_6\right]^{3-}$

$\left[Cr\left(NH_3\right)_6\right]^{3-}(f)\left[Zn\left(NH_3\right)_4\right]^{2+}$

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

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9. From the experimental facts given below determine the correct structure of solid $CrCI_3.6H_2O$ Solution containing $0.2665g$ of $CrCI_36H_2$ O was passed throuhg cation exchange resin in acid form The acid liberated was found to react completely with $30mL$ of $0.10M$ Na OH $\left(\text{Molecular mass of} CrCI_3.6H_2O = 266.5\right)$.

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10. Which of the following complexes (in solution) will have greater value of molar conductivity Explain giving reason

$K_4\left[Fe(CN)_6\right]$ and $K_3\left[Fe(CN)_6\right]$

(b) $Pt\left[\left(NH_3\right)_2CI_2\right]$ and $\left[Pt(NH)_3\right)_6\right]CI_4$.

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11. Arrange the following compounds in the order of decreasing molar conductivity in aqueous solution.

$i.\ a.\ K\left[Co\left(NH_3\right)_2\left(NO_2\right)_4\right]$

$b.\ \left[Cr\left(NH_3\right)_3\left(NO_2\right)_3\right]$

$c.\ \left[Cr\left(NH_3\right)_5\left(NO_2\right)\right]_3\left[Co\left(NO_2\right)_6\right]_2$

$d.\ \left[Mg\left(Cr\left(NH_3\left(NO_2\right)_5\right]$

$ii.\ a.\ Li\left[Co\left(NH_3\right)_2\left(NO_2\right)_4\right]$ $b.\ Na\left[Co\left(NH_3\right)_2\left(NO_2\right)_4\right]$

$c.\ K\left[Co\left(NH_3\right)_2\left(NO_2\right)_4\right]$ $d.\ Cs\left[Co\left(NH_3\right)_2\left(NO_2\right)_4\right]$

$iii.\ a.\ Pt\left(NH_3\right)_6Cl_4 b.\ Cr\left(NH_3\right)_6Cl_3$

$c.\ Co\left(NH_3\right)_4Cl_3$ $d.\ K_2PtCl_6$

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12. Arrange the following compounds in the order of decreasing molar conductivity in aqueous solution.

$i.\ a.\ K\left[Co\left(NH_3\right)_2\left(NO_2\right)_4\right]$

$b.\ \left[Cr\left(NH_3\right)_3\left(NO_2\right)_3\right]$

$c.\ \left[Cr\left(NH_3\right)_5\left(NO_2\right)\right]_3\left[Co\left(NO_2\right)_6\right]_2$

$d.\ \left[Mg\left(Cr\left(NH_3\left(NO_2\right)_5\right]\right.\right.$

$ii.\ a.\ Li\left[Co\left(NH_3\right)_2\left(NO_2\right)_4\right]$ $b.\ Na\left[Co\left(NH_3\right)_2\left(NO_2\right)_4\right]$

$c.\ K\left[Co\left(NH_3\right)_2\left(NO_2\right)_4\right]$ $d.\ Cs\left[Co\left(NH_3\right)_2\left(NO_2\right)_4\right]$

$iii.\ a.\ Pt\left(NH_3\right)_6Cl_4 b.\ Cr\left(NH_3\right)_6Cl_3$

$c.\ Co\left(NH_3\right)_4Cl_3$ $d.\ K_2PtCl_6$

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13. Calculate the EAN of CO in $\left[Co\left(NH_3\right)_6\right]^{3+}$(Atomic number of $Co = 27)$.

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14. On the basis of EAN rule predict the number of unpaired electrons and magnetic (μ) moment for the following compounds

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

(ii) $\left[Cr\left(NH_3\right)_6\right]Cl_2$

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15. Calculate the EAN of the underlined atoms in the folloiwng complexes .

$\left[C\underline{a}(edta)\right]^{2-}$

(b) $\left[Ni(py)(en)\left(NH_3\right)_3\right]^{2+}$.

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16. Dedue the value of x in the following compounds.

(a) $\left[Mo(CO)_x\right]$ (b) $\left[Co_2(Co)_x\right]^{2-}$

(c) $Hx\left(Cr(CO)_5\right.$ (d) $HxCo(CO)_4$

(e) $\left[Fe\left(C_5H_5\right)_2\right]$ (f) $\left[Cr\left(C_6H_6\right)_2\right]$.

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17. Describe a simple test to distinguish between the following pairs of compounds

(i) (A) $\left[Co\left(NH_3\right)_5Br\right]SO_4$ and (B) $\left[Co\left(NH_3\right)_5SO_4\right]Br$

(ii) (A) $\left[Cr\left(H_2O\right)_6\right]CI_3$ and $(B)\left[Cr\left(H_2O\right)_5CI\right]CI_2H_2O$

(iii) (A) $cis\left[PtCI_2\left(NH_3\right)_2\right]$ and (B) trans $\left[PtCI_2\left(NH_3\right)_2\right]$

(iv) (A) and (B) Two enantiomers of $\left[Co(en)_2\left(NH_3\right)_2\right]$

(V) (A) (A) $\left[Cr\left(NH_3\right)_6\right]\left[Cr\left(NH_3\right)_2\left(NO_2\right)_4\right]$

(vi) (A) $\left[Pt\left(NH_3\right)_2CI_2\right]$ and (B) $\left[Pt\left(NH_3\right)_6\right]CI_2$

(vii) (A) $\left[Co\left(NH_3\right)_5CI\right]SO_4$ and (B) $\left[Co\left(NH_3\right)_5SO_4\right]CI$.

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18. Write hydrate isomers of the following and also give increasing order of the conductance of the isomers

$\left[Cr\left(H_2O\right)_6\right]Br_3$

(b) $\left[Cu\left(H_2O\right)_4\right]CI_2$.

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19. Why is geometrical isomerism not possible in tetrahedral complexes having two different types of unidentate ligands coordinated with central metal ion ? .

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20. Draw structures of geometrical isomers of $\left[Fe(CN)_4(Nh_3)_2\right]^{\Theta}$.

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21. Draw structures of geometrical isomers possible for $\left[Co(en)CI_2Br\right]^{\Theta}$.

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22. In the reaction

$\left[CoCI_2(NH_3)_4\right]^{\oplus} \rightarrow \left[CoCI_3(NH_3)_3\right] + NH_3$, only one isomer of the complex product is obtained Is the initial complex cis or trans ? .

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23. When $\left[Ni\left(NH_3\right)_4\right]^{2+}$ is treated with conc HCI two compounds having the formula $Ni\left(NH_3\right)CI_2$ (designated as I and II are formed) I can be converted into II ny boiling in dil HCI A solution of I reacts with oxalic acid to form $Ni\left(NH_3\right)_2\left(C_2O_4\right)$ II does not react with oxalic acid Deduce the configuration Of I and II and the geometry of Ni (II) complexes .

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24. How can be the following pair of isomers be distinguished from one another

I $\left[Co\left(NH_3\right)_6\right]\left[Cr\left(NO_2\right)_6\right]$ and

(II) $\left[Cr\left(NH_3\right)_6\right]\left[Co\left(No_2\right)_6\right]$

I $\left[Cr\left(NH_3\right)_6\left[Cr\left(No_2\right)_6\right]\right.$ and (II) $\left[Cr\left(NH_3\right)_4\left(No_2\right)_2\right]\left[Cr\left(NH_3\right)_2\left(NO_2\right)_4\right]$.

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25. Write all geometric isomers for an octahedral complex $\left[MCI_2\left(NH_3\right)_4\right]$.

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26. Out of the following two coordination entities Which is chiral (optically active)

(a) cis - $\left[CrCI_2(OX)_2\right]^{3-}$

$trans$ - $\left[CrCI_2(OX)_2\right)]^{3-}$.

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27. Write the structure and name of the following and their ionisation isomers

$\left[Pt\left(NH_3\right)_3\left(NO_2\right)\right]CI$

(ii) $\left[Pt\left(NO_2\right)\left(H_2O\right)\left(NH_3\right)_2\right]Br$

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

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28. A coordination compound $CrCI_3.4H_2O$ precipitates $AgCI$ when treated with $AgNO_3$ The molar conductance of its solution corresponds to a total of two ions Write the structural formula of the compound and name it .

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29. Writh the structure and name og the following and their coordination isomers .

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30. Draw the structures and write the names of all possible isomers of

(A) $\left[Pt(SCN)\left(NH_3\right)SCN\right.$

(ii)(B) $\left[Co(SCN)\left(NH_3\right)_5\right]CI_2$

(iii) (C) $\left[Co\left(NH_3\right)_5\left(NO_2\right)\right]^{2+}$.

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31. The complex ion $\left[Co\left(NH_3\right)_5CI\right]^{2+}(X)$ undergoes a substitution reaction when reacted with $\left(NaNO_2 + HCI\right)$ An unstable scarlet red complex A is formed when dilute acid is used and a stable yellow complex B is formed when concentrated acid is used Both A and B are isomeric pentammine complex ions Give the structures of the ions und name the type of the isomerism involved .

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32. What type of isomers are the following

(a) $\left[Mn(CO)_5(SCN)\right]$ and $\left[Mn(CO)_5(NCS)\right]$

(b) $[Co(en)$ - $(3)]\left[Cr(CN)_6\right]$ and $\left[Cr(en)_3\right]\left[Co(CN)_6\right]$

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

(d) $\left[Co(py)_2\left(H_2O\right)_2CI_2\right]CI$ and $\left[Co(py)_2\left(H_2O\right)CI_3\right]H_2O$

(II) (a) $\left[Cr\left(NH_3\right)_6\right]\left[Cr(CN)_6\right]$ and $\left[Cr\left(NH_3\right)_4(CN)_2\right)\right]\left[Cr\left(NH_3\right)_2(CN)_4\right]$

(b) $\left[Pt\left(NH_3\right)_4Br_2\right]CI_2$ and $\left[Pt\left(NH_3\right)_4CI_2\right]Br_2$.

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33. Draw all possible isomers of

(i) $\left[Pt\left(NH_3\right)_4CI_2\right]^{2+}$

(ii) $\left[Pt(gly)_2\right]^0$

(ii) $\left[Pt\left\{P\left(C_2H_5\right)_3\right\}CI_2\right)]_2$

(iv) $\left[Cr\left(NH_3\right)(OH)_2CI_3\right]^{2--}$.

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34. Neither optical nor geometrical isomers can be distinguished by mass spectroscopy. Why

(ii) Select the pairs of

(a) Geometrical isomers,(b) Optical isomers

(c) Identical structures

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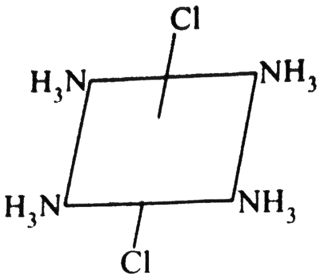
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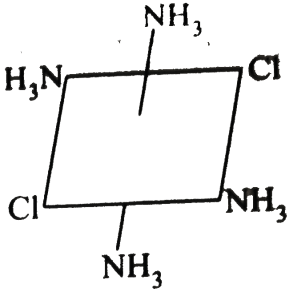
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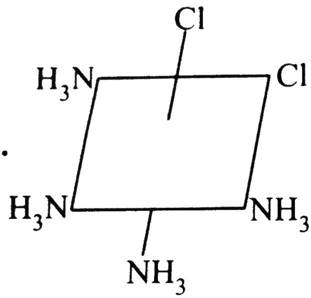
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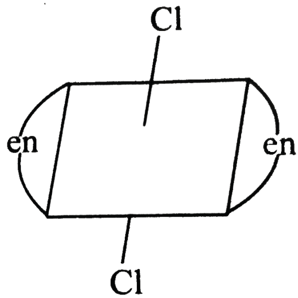
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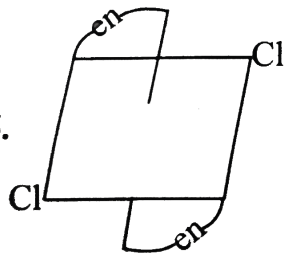
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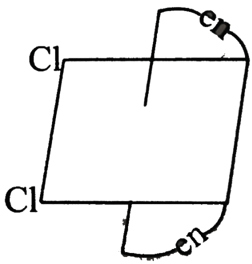
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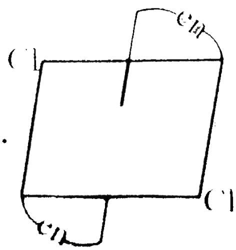

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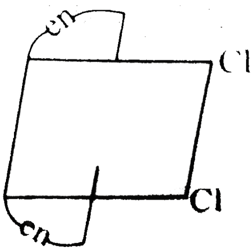
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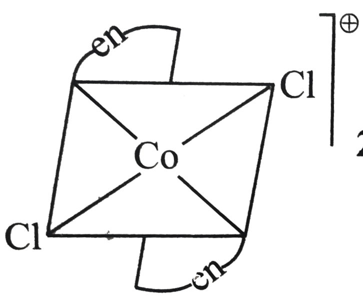
1. 
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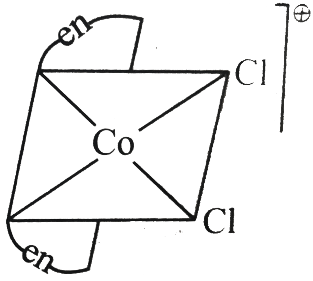
2. 
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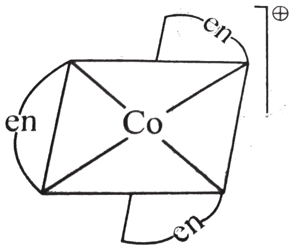
3. 
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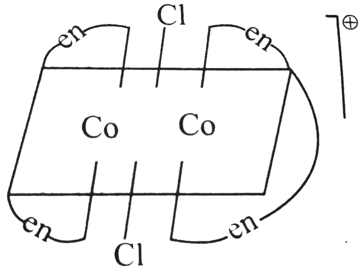
4. 
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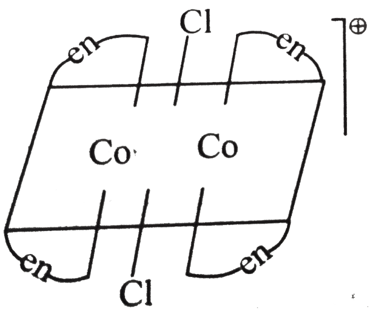
5. 
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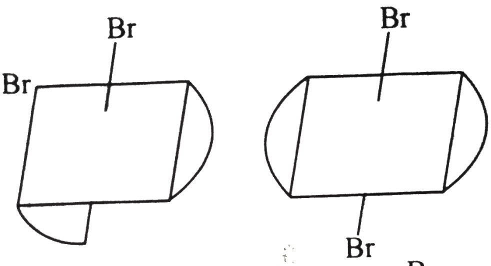

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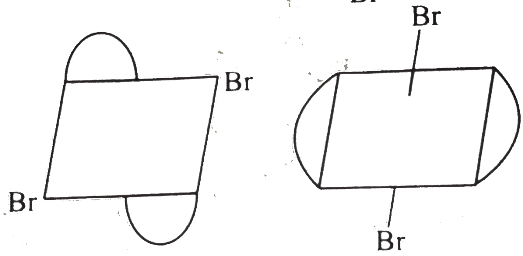

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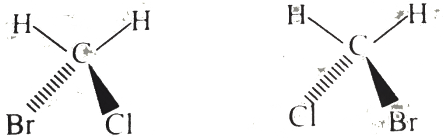

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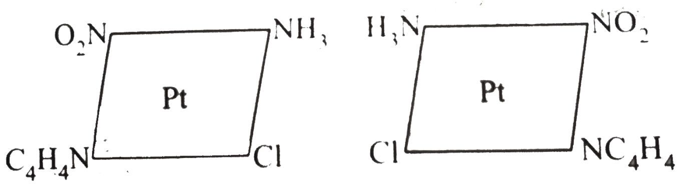

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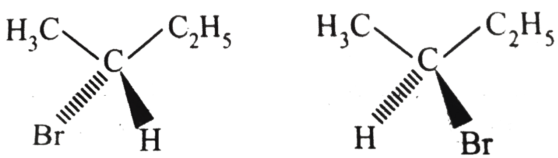

(III) Which one of followig will show optical activity

Identifly the type of insomerisum in (if no isomerism then indicate none

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35. The spin only magnetic moment value of $[MnBr_4]^{2-}$ ion is $5.9BM$ On the basis of VBT Predict the hybridisation and geometry of $[MnBr_4]^{2-}$ ion ` .

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36. Predict the number of unpaired electrons in square planar $[PtCI_4]^{2-}$ ion .

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37. Magnetic moment value of $[Mn(CN)_6]^{3-}$ ion in $2.8BM$ Predict the type of hybridisation and geometry of the ion .

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38. Megnetic moment value of $Fe\left(H_2O\right)_5(NO)]^{2+}$ ion in $3.89B.M$

Find the out the oxidation state of iron and type of hybridisation .

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39. In what repects do inner orbital octahedral complexes differ from outer orbital octahedral complexes

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40. $In\left[ZnBr_4\right]^{2-}$ electron pairs in sp^3 hybrid orbitals of the zinc atom form bonds to the bromineatoms Determine the number of unpaired electrons in the complex .

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41. Prove that the lowering of the stabilised orbitals is $0.4\Delta_0$ while raising of the destabilised orbitalsw is $0.6\Delta_0$.

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42. For the complex $\left[Cr\left(H_2O\right)_6\right]^{2+}$ calculate the total pairing energey in high spin and low spin state Given the mean pairing energey $= 23500cm^{-1}$.

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43. Which complex of the following pairs has the larger value of Δ_0

(i) $\left[Co(CN)_6\right]^{3-}$ and $\left[Co\left(NH_3\right)_6\right]^{3+}$

(ii) $\left[Co\left(NH_3\right)_6\right]^{3+}$ and $\left[CoF_6\right]^{3-}$

(iii) $\left[Co\left(H_2O\right)_6\right]^{2+}$ and $\left[Co\left(H_2O\right)_6\right]^{3+}$.

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44. For Mn^{3+} ion the electron pairing energey P is $28000cm^{-1}\Delta_0$ values for the complexes $\left[Mn\left(H_2O\right)_6\right]^{3+}$ and $\left[Mn(CN)_6\right]^{3-}$ are $21000cm^{-1}$ and $38500cm^{cm-1}$ and $38500cm^{-1}$ respectively Do these complexes have high spin or low spin complexes Also write the configuration corresponding to these states .

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45. For $\left[Cr\left(H_2O\right)_6\right]^{2+}$ ion the mean pairing energey P is found to be $23500cm^{-1}$ The magnitude of Δ_0 is for the complex in configurations corresponding to high spin and low spin states Which is more stable ?

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46. Give reason for the fact that crystal field theory is not applied to complexes of many group metals .

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47. Using CFT depict the electronic configuration of the rhodium ion $\left(Rh^{2+}\right)$ in an octahedral field for which the crystal field splitting Δ_0 is greater than the pairing eneryg P

(b) Calculate the crystal field stabilisation energey for this configuration (in terms of Delta andP)` .

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48. What factor determines whether the crystal field in an octahedral complex is to be regarded as strong or weak? How many d-electrons must be present in orbitals of the central atom atom for there to be

an abrupt change in crystal field stabilisation energy strong and weak fields gt

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49. Explain the following giving reasons

(a) $\left[NiCI_4\right]^{2-}$ is tetrahedral and paramagnetic whereas $\left[Ni(CN)_4\right]^{2-}$ is square plannar and dimagnetic

(b) $\left[Fe\left(H_2O\right)_6\right]^{3+}$ ion is more paramagnetic than $\left[Fe(CN)_6\right]^{3-}$ ion

(c) $Ni(CO)_4$ is tetrahedral while $\left[Ni(CN)_4\right]^{2-}$ ion is square planar

(d) $\left[Co\left(F_6\right)\right]^{3-}$ is a high spin complex whereas $\left[Co(CN)_6\right]^{3-}$ ion is a low spin complex .

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Solved Examples

1. Addition of $AgNO_3$ solution to aqueous solution of each of the $Pt(IV)$ amines viz (i) $PtCI_4.6NH_3$ (ii) $PtCI_4.5NH_3$ (iii) $PtCI_4$ (iv) $PtCI_4.3NH_3$ and (v) $PtCI_4.2NH_3$ was found by Werner to give $4, 3, 2, 1$ and zero moles of $AgCI$ per mole of the amines repectively How did Werner explain these observations? .

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2. Three compounds A, B and C have empirical formula $CrCI_3.6H_2O$ When 1 go of A was kept in a container with dehydrating agent it lost water content and attained constant weight of $0.865g$ When 1 g B was kept in that vessel it attained a constant weight of $0.932g$ Compund C showed no loss in water content .

(a) Find the composition of A, B and C

If an excess of aqueous $AgNO_3$ solution is added to $1g$ solution of A, B and C what amount of $AgCI$ will be precipitated in each case .

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3. Calculate the EAN of the central metal in the following complex

(a) $\left[AuCI_2\right]^{\Theta}$,(b) $\left[AI\left(C_2O_4\right)_3\right]^{3-}$,(c) $\left[(CdI)_4\right)]^{\Theta}$.

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4. Use the EAN rule to predict the molecular formula for the simple carbonyls of (a) $Cr(Z = 24)$

(b) $Fe(Z = 26)$ and (c) $Ni(Z = 28)$ (Assume that the oxidation state of the metals in the these carbonyls is zero) .

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5. A compound with the empirical formula $Co\left(NH_3\right)_5SO_4$Br exists in two forms viz red and violet forms Solution of red form gives a precipitate of $AgBr$ with $AgNO_3$ solution The violet form gives no precipitate with $AgNO_3$ but gives white precipitate with the aquous solution of $BaCI_2$ From the these observations give the structure of each form .

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6. Two complexes with empirical formula $Co(NH_3)_3(H_2O)_2Br_2CI$ exists in two isomeric forms (A) and (B) Form A gives two moles of AgBr On treatment with $AgNO_3$ solution whereas form B gives only one mole of AgBr Give the structural formula of both these isomers What are these isomer called .

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7. Two complexes with empirical formula $Co(NH_3)_3(H_2O)_2Br_2CI$ exists in two isomeric forms (A) and (B). Form A gives two moles of AgBr on treatment with $AgNO_3$ solution whereas form B gives only

one mole of AgBr. Give the structural formula of both these isomers.

What are these isomer called?

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8. How many isomers are possibel for the complex ion $\left[Cr\left(NH_3\right)(OH)_2CI_3\right]^{2-}$?

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9. For the square planar complex $\left[Pt\left(NH_3\right)_4\left(NH_2OH\right)py\left(No_2\right)\right]^{\oplus}$ how many geometrical isomers are possible .

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10. Give the total number of geometrical and optical isomers give by

(i) $\left[Co\left(NH_3\right)_4CI_2\right]^{\oplus}$

(ii) $\left[Pt(en)Br_2CI_2\right]$

(iii) $\left[CrCI_3\left(H_2O\right)_3\right]$.

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11. How many geometrical isomers are there fore

(a) $\left[Co\left(NH_3\right)_2CI_4\right]^{\Theta}$

(b) $\left[AuCI_2Br_2\right]^{\Theta}$ (square planar) (c) $\left[CuCI_2Br_2\right]^{2-}$ (tetrahedral) .

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12. Acomplex of the type $\left[M(AA)_2X_2\right]$ is known to the optically active What does this indicate about the structure of the complex Give one example of such complex .

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13. The formula $Co\left(NH_3\right)_4 CO_3$ Br represents three isomers

(i) Draw their structures

(ii) How would you distinguish these isomers ?

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14. On the basic VBT answer the following questions for the 4-coordinated complex compounds

(a) $\left[CoBr_4\right]^{2-}$, (b) $\left[Zn(CN)_4\right]^{2-}$, (c) $\left[MnCI_4\right]^{2-}$

(i) What is the oxidation state of the central metal atom//ion?

(ii) What type of hybridisation is involved?

(iii) What is the geometry and magnetic behaviour of the complex ion/compound

(iv) Calculate the value of $\mu_{s\pi n}$ only .

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15. Explain why a knowledge of magnetic suceptilbility of a complex is often necessary for a correct assignment of the electronic conifiguration according to valence bond theory

(b) Draw valence bond representations of the electronic structures of (i) $\left[CoF_6\right]^{3-}$ (paramagnetic) and (ii) $\left[Co(CN)_6\right]^{3-}$ (diamagnetic) .

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16. Magetic moment of $\left[CoI_4\right]^{2-}$ is 3.8BM Using valence bond approach predict the structure of $\left[CoI_4\right]^{2-}$.

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17. A complex of a certain metal ion has a magnetic moment of $4.90BM$ Another complex of the same metal ion in the same oxidation state has zero magnetic moment The central metal ion could be which of the following (a) Cr^{3+} ,(b) Mn^{3+} (c) Fe^{2+} (d) Co^{2+}

(ii) Refer to the question above if a metal ion has complex ion and with magnetic moments 4.90 and $2.8BM$ which one of these is the central metal ion

(a) Cr^{3+} (b) Mn^{3+} , (c) Fe^{2+} (d) Co^{2+} .

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18. Find out the number of unpaired electrons in strong and weak octahedral for Cr^{3+} and Fe^{2+} ions .

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19. Distinguish between the possibillities in complex ions of $\Delta = 0$ and $CFSE = 0$ Give an example of each .

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20. Determine the crystal field stabilisation energy of a d^6 complex having $\Delta_0 = 25000 cm^{-1}$ and $P = 1500 cm^{-1}$.

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21. Give reason for the fact that amongst $Ni(CO)_4\left[Ni(CN)_4\right]^{2-}$ and $NiCI_4^{2-}$, $Ni(CO)_4$ and $\left[Ni(CN)_4\right]^{2-}$ are diamagnetic whereas $\left[NiCI_4\right]^2$ is paramagnetic are diamagnetic whereas $\left[NiCI_4\right]^2$ is paramagnetic .

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22. One the basic of CFT predict the geometry of the compund $K_3\left[Mn(CN)_6\right]$ Also calculate the value of $\mu_{s\pi n}$ only of the compund .

Watch Video Solution

23. The enthalpy of hydration of theFe^{2+} ion is $11.4kcal/mol$ higher than would be expected if there were no crystal field stabillisation energey Assuming the equo complex to be high spin estimate the magnitude of Δ_0 for $\left[Fe\left(H_2O\right)_6\right]^{2+}$ ion .

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24. If a complexing metal of the first transition series has a di configuration for what values of could magntic properties alone distinguish between strong field and weak field ligand in octanderal coordination .

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25. In terms of CFT explain why a d^9 octahedral complex with six identical ligands is not expected tom have all size $m - L$ distane identical .

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26. Derive the geometry of the complex compound corresponding to the brown ring in nitrate test Predict the magnetic moment of the complex .

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27. Which of the electronic configuration according to crystal field theory of the compound is correct $\left[MnF_6\right]^{4-}$? .

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

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

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

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

Answer: b

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28. Which of the electronic configuration according to crystal field theory of the compound Rh^{+2} with $CN = 6$ is correct when $\Delta > P$? .

A. $a.\ \left(t_{2g}^{6}e_{g}^{1}\right)$

B. $b.\ \left(t_{2g}^{5}e_{g}^{2}\right)$

C. $c.\ \left(t_{2g}^{5}e_{g}^{1}\right)$

D. $d.\ \left(t_{2g}^{3}e_{g}^{3}\right)$

Answer: b

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29. According to crystal field therory the electronic configuration of the $\left[Cr\left(H_2O\right)_6\right]^{2+}$ ion when $(\Delta < P)$

$(\Delta = CFSE, P = \text{Pairing energy})$.

A. $3\left(t_{2g}^{3}e_{g}^{1}\right)$

B. $4\left(t_{2g}^{3}e_{g}^{1}\right)$

C. $3\left(e_{g}^{1}t_{2g}^{1}\right)$

D. $3\left(e_{g}^{3}t_{2g}^{1}\right)$

Answer: a

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30. According to crystal field theory the electronic configuration of the $\left[FeCl_4\right]^-$ ion is .

A. $\left(t_{2g}^{2}e_{g}^{2}\right)$

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

C. $\left(e_{g}^{1}t_{2g}^{3}\right)$

D. $\left(e_g^3 t_{2g}^1\right)$

Answer: B

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31. According to crystal field theory the electronic configuration of the compound $\left[Mn(CN)_4\right]^{2-}$ is $(\Delta > P)$:

A. $4\left(e^4 t_2^1\right)$

B. $\left(e^2 t_2^3\right)$

C. $4\left(e^2 t_2^3\right)$

D. $3\left(e^4 . t_2^1\right)$.

Answer: d

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32. Corystal field splitting energy $(CFSE)$ for the complex $\left[Cr\left(H_2O\right)_6\right]^{2+}$ is when $(\Delta < P)$.

A. $1.2Delat_0$

B. $-0.6\Delta_0$

C. $0.6\Delta_0$

D. $1.2\Delta_0$

Answer: b

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33. Crystal field splitting energy $(CFSE)$ for the complex $\left[Cr\left(NH_3\right)_6\right]^{2+}$ is (when $\Delta > P$) .

A. $-1.6\Delta_0 + P$

B. $1.6\Delta_0 + P$

C. $-c-24\Delta_0+P$

D. $2.4\Delta_0+P$

Answer: a

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34. Crystal field splitting energy $(CFSE)$ for the complex $\left[Cr\left(H_2O\right)_6\right]^{2+}$ is when $P=20925cm^{-1}$ and $\Delta_0=10462.5cm^{-1}\left(1kJmo1^{-1}=83.7cm^{-1}\right)$.

A. $a.\ -75kJmo1^{-1}$

B. $b.75kJmo1^{-1}$

C. $c.750kJmo1^{-1}$

D. $d.\ -750kJmo1^{-1}$

Answer: a

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35. Crystal field splitting energy $(CFSE)$ for the complex $\left[Cr\left(NH_3\right)_6\right]^{2+}$ is when $P = 125$ and $\Delta_0 = 250 kjmol^{-1}$.

A. $525 kJmo1^{-1}$

B. $275 kJmo1^{-1}$

C. $-275 kJmo1^{-1}$

D. $-525 kJm01^{1-}$

Answer: c

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36. Crystal field splitting energey $(CFSE)$ for the complex $\left[Cr\left(NH_3\_(6)\right]^{2+}$ is when $P = 125$ and $\Delta_0 = 250 kJmo1^{-1}$.

A. d^5

B. d^6

C. d^8

D. d^{10}

Answer: a

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37. In which structure crystal field splitting energey $(CFSE)$ for octahedral complex will be zero when $\Delta < P$.

A. d^5

B. d^6

C. d^8

D. d^{10}

Answer: d

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38. In which structure crystal field splitting energey $(CFSE)$ for octahedral complex will be zero when $\Delta < P$.

A. $-1.0\Delta_t$

B. $1.0\Delta_t$

C. 0

D. $-1.8\Delta_t$

Answer: c

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39. Crystal field splitting energey $(CFSE)$ for the complex $\left[Fe(CN)_4\right]^{\Theta}$ is when $\Delta > P$.

A. $a)$ - 2.0

B. $b)\Delta + P$

C. $c)2 + P$

D. $d)0$

Answer: d

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40. Crystal field splitting energey $(CFSE)$ for the complex $\left[Fe(O)_4\right]^{2-}$ is when $\Delta = 125$ and $P = 250kJmo1^{-1}$.

A. $-1.2\Delta_t$

B. $1.2\Delta_t$

C. -8

D. 8

Answer: a

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41. $CFSE$ for d^6 octahedral complex having $\Delta = 250$ and $P = 125 kJmo1^{-1}$ is .

A. $350 KJMO1^{-1}$

B. $-350 kJmo1^{-1}$

C. $475 kJmo1^{-1}$

D. $-475 kJmo1^{-1}$

Answer: b

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42. The enthalpy of hydration of Cr^{+2} is -460 kcal $mo1^{-1}$ In the absence of $CFSE$ the value for $\Delta H =$ - 424 kcal $mo1^{-1}$ What is the value of Δ_0 for $\left[Cr\left(H_2O\right)_6\right)]^{2+}$.

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

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

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

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

Answer: a

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Ex 7.1 Subjective (Terminology)

1. Write the formula of the following compounds according to the $IUPA$ rule

(a) Potassium tetraxoferrate (IV)

(b) Potassium tetrazidocobalt(II)

(c) Dichloridobis (triphenylphosphine) nickel(II)

(d) Chloridocarbonylbis (tripheny1 phosphine)iridium(I)

(e) Haxammine coblt (III) Pentachloridocuperate(II)

(f) Tetrammine - mu dihydroxobis (ethylenediamine) dicobalt(III) chloride

(g) Dibromidotetra ammine cobalt (III) tetrachloridozincate(II)

(h) Hexammine nicke (II) hexanitrocobaltate(II)

(i) Haxammine cobalt(III) tetrachloridodiammine chromate(III) .

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2. Name of the following compounds

(a) $\left[Fe\left(CI_2\left(H_2O\right)_4\right]^{\Theta}\right.$,

(b) $[Cr(en)_2CI_2]CI$

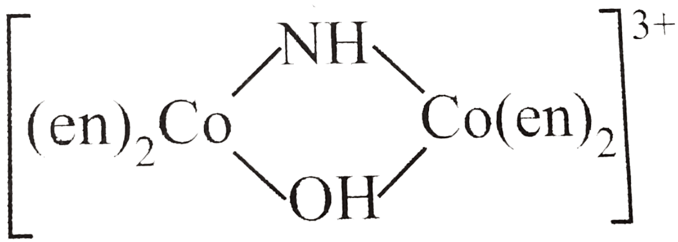
(c) $[Pt(Py)_4][PtCI_4]$

(d) $[Co(en)_2(CN)_2]CIO_3$

(e) $CsTeF_5$

(f) $[Co(NH_3)_5CO_3]_2[CuCI_4]$

$NaMn(CO)_5$ (h) $(NH_4)_2TiCI_6$

i. 

(j) $[Cr(acac)_3]$

(k) $[Ni(dmg)_2]$

l $SnCI_4(Et_2NH_2)$

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3. Give the characteristic coordination number of each of the following central metal ions .

(a) `Cu(I)

Cu(II)

(c) CO(III) lt brgt (d) Al(III) lt brgt (e) Zn(II)

(f) Fe(II)

(g) Fe(III)

(h) Ag(I) .

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4. Indicate the oxidation state of the central metal ion in each of the following complex

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

(b) $\left[Cu\left(Br_4\right)\right]^{2-}$

(c) $\left[Cu(CN)_2\right]^{\Theta}$

(d) $\left[Cu\left(NH_3\right)_4CO_3\right]^{\oplus}$

(e) $\left[PtCI_4\right]^{2-}$

(f) $\left[Co\left(NH_3\right)_2\left(NO_2\right)_4\right]^{\Theta}$

(g) $Fe(CO)_5\Big)$

(h) $\left[ZnCI_4\right]^{2-}$

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

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5. Calucultae the freezing point of the solution containing $24.8g$ solute per kg water for each of the following solutes $K_f = 1.86C/m$

(a) $\left[Co\left(NH_3\right)\left(NO_{2\,-\,(3)}\right]$

(b) $\left[Co\left(NH_3\right)_4\left(NO_2\right)\right]\left[Co\left(NH_3\right)\left(NO_2\right)_4\right]$

(c) $\left[Co\left(NH_3\right)_5\left(NO_2\right)\left[Co\left(NH_3\right)\left(NO_2\right)_4\right]^2\right.$

[Mw of (a) `248g (b) 496 g (c) 744 g]

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Ex 7.1 Subjective (Effective Atomic Number (Ean))

1. Calculate EAN in

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

(b) $\left[PdXCI_4\right]^{2-}$

(c) $\left[Pt\left(NH_3\right)_4\right]^{2+}$

(d) $\left[Cu(CN)_4\right]^{3-}$.

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2. Calculate "EAN" of metal atoms in the following

$Fe(CO)_5$

(b)$Co_2(CO)_8$

(c) $Fe(NO)_2(CO)_3$

(d) $Fe\left(C_5H_5\right)_2$.

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3. Dedue the value of x in the following compounds.

(a) $\left[Mo(CO)_x\right]$ (b) $\left[Co_2(Co)_x\right]^{2-}$

(c) $Hx\left(Cr(CO)_5\right.$ (d) $HxCo(CO)_4$

(c) $\left[Fe\left(C_5H_5\right)_x\right]$ (d) $\left[Cr\left(C_6H_6\right)_x\right]$.

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Ex 7.1 Subjective (Conductance In Coordination Compounds)

1. Arrange the following compounds in the order of decreasing molar conductivity in aqueous solution.

$i.\ a.\ K\left[Co\left(NH_3\right)_2\left(NO_2\right)_4\right]$

$b.\ \left[Cr\left(NH_3\right)_3\left(NO_2\right)_3\right]$

$c.\ \left[Cr\left(NH_3\right)_5\left(NO_2\right)\right]_3\left[Co\left(NO_2\right)_6\right]_2$

$d.\ \left[Mg\left(Cr\left(NH_3\left(NO_2\right)_5\right]\right.\right.$

ii. a. $Li[Co(NH_3)_2(NO_2)_4]$ b. $Na[Co(NH_3)_2(NO_2)_4]$

c. $K[Co(NH_3)_2(NO_2)_4]$ d. $Cs[Co(NH_3)_2(NO_2)_4]$

iii. a. $Pt(NH_3)_6Cl_4$ b. $Cr(NH_3)_6Cl_3$

c. $Co(NH_3)_4Cl_3$ d. K_2PtCl_6

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2. Two compounds have the empirical formula $Cr(NH_3)_3(NO_2)_3$ In aqueous solution one of these conducts electricity while the other does not Deduce their probable structures .

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Ex 7.1 Subjective (Isomerism In Coordination Compounds)

1. how will you distinguish between the following pairs of isomers

$\left[Cr\left(NH_3\right)_3\left(NO_2\right)_3\right]$ and $\left[Cr\left(NH_3\right)_6\right]\left[Cr\left(NO_2\right)_6\right]$

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2. How many geometrical isomers are possible for the complex ion $\left[Cr\left(NH_3\right)(OH)_2CI_3\right]^{2-}$.

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3. The complex $M\left(C_4O_4\right)CI_2\left(NH_3\right)_2$ forms two types of ionic coloured crystals viz red (A) and blue (B) A or B reacts with 1 mole of $AgNO_3$ to give $1/2$ mole of a red precipitate Further 1 mole of A reacts slowly with 1 mole of $Ag_2C_2O_4$ to form 2 moles of a white precipitate bit B does not react with $Ag_2C_2O_4$ From the above data Find

(a) the coordination number of M

(b) the hybrid orbitals of M and

(c) stereochemistry of red and blue forms .

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4. The compound $Co(en)_2(NO_2)_2CI$ has been prepared in these isomeric forms A, B and C A does not react with $AgNO_3$ or (en) and is optically inactive B reacts with $AgNO_3$ but not with (en) and is optically inactive C is optically active and reacts with both $AgNO_3$ and (en) identify each of these isomeric forms and draw their structures .

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5. A solution containing 1 go of the complex

$\left[Cr(H_2O)_5CI\right]CI_2H_2O$ was passed through a cation exchanger The acid liberated was made up to 1 litre Calculate the strength of acid solution ($AwofCr = 52$ and Mw of complex $= 266.5gmo1^{-1}$.

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6. A solution containing $2.675g$ of $CoCI_3.6NH_3$ was passed through a cation exchanger The solution obtained gave 4.305 g of $AgCI$ precipitate with $AgNO_3$ solution Determine the formula of the complex

$\left(MwofCoCI_3.6NH_3 = 267.5\right)$.

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Ex 7.1 Objective (Terminology)

1. The oxidation number of Co in $\left[Co(en)_3\right]_2\left(SO_4\right)_3$ is

$+2$

$+1$

$+3$

$+6$.

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2. The $IUPAC$ name of the coordination compound $Na_3\left[Ag\left(S_2O_3\right)_2\right]$ is

(a) Sodium silverthiosulphate (I)

(b) Sodium silverhyposulphate (I)

(c) Sodium bis [argentothiosulphate(I)]

(d) Sodium bis (thiosulphato)argentite .

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3. The $IUPAC$ name of the coordination compound $\left[CuCI_2\left(CH_3NH_2\right)_2\right]$ is

(a) Dimethylamine copper(II)chloride

(b) Bis(dimehtylamine copper(II) chloride

(c) Dichloridobis(methylamine)copper(II)

(d) Dichlorobis(dimethylamine) copper(II) .

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4. The $IUPAC$ name for $\left[AI(OH)\left(H_2O\right)_5\right]^{2+}$ is

(a) Pentahyroaluminium hydroxide

(b) Aquometaaluminate ion

(c) Pentaaquaaluminate(III)hydroxide

(d) Pentaaquahydroxoaluminium(III) .

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5. The $IUPA$ name of $\left[Pt(Br)(CI)\left(NH_3\right)_3\left(NO_2\right)\right]CI$ is

(a) Triamminechloridobromidonitroplatinum(IV) chloride

Triamminechloridobromidonitroplatinum(IV) chloride

Triamminechloridobromidonitroplatinum(IV) chloride

Triamminechloridobromidonitroplatinum(IV) chloride .

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6. The oxidation number of Cr in $\left[Cr\left(C_6H_2\right)_2\right.$ is

0 (b) $+2$

(c) $+3$

(d) $+6$.

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7. Which of the following has five donor (coordinating) sites?

(a) Ethylenediaminetriacetate ion

(b) Diethylene triamine

(c) Ethylenediaminetetracetate ion

(d) Triethylene tetramine .

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8. Which of the following is not chelating agent

(a) Thiosulphate

(b) Oxalato

(c) Glycinato

(d) Ethylene diamine .

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9. The solution of $AgBr$ in presence of large excess of NH_3 contains mainly the cation.

(a) $NH_4^{\oplus}$

$Ag^{\oplus}$

(c) $\left[Ag\left(NH_3\right)\right]^{\oplus}$

(d) $\left[Ag\left(NH_3\right)_2\right]^{\oplus}$.

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10. Which of the following species is not expected to be a ligand

$\overset{\oplus}{NO}$

$NH_4^{\oplus}$

(c) NH_2 - $NH_3^{\oplus}$

(CO) .

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11. The number of donor sites in dimethy1 glyoxime glycinato diethylene triamine and $EDTA$ are respectively

2, 2, 3 and 4

(b) 2, 2, 3 and 6

(c) 2, 2, 2 and 6

2, 3, 3 and 6 .

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12. Which of the following is a double salt ?

A. Alum

B. Chrome alum

C. Microcosmic Salt

D. All of these

Answer: D

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13. When potash alum is dissolved in water the total number of ions produced is.

A. Four

B. Eight

C. Ten

D. Thirty Two

Answer: B

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14. Which of the following statements is correct with regard to complex ion ? .

(a) complex ion consists of a central ion bonded to two or more donor ions or molecules usually does not dissociate into simple ions or molecules even in a solution and exhibits properties different from its constituent ions or molecules

(b) The donor ions and molecues which coordinate with the central atom or ion a complex are called ligands

The sum of the number of electrons pressent in the central metal ion or atom and those donated by the ligands is called the effective atomic number of the central metal aton and this number is usually the same as the atomic number of the next higher noble gas

(d) All of these .

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15. How many mloes of of $AgCI$ would be obtained when $100mL$ of $0.1MCo\left(NH_3\right)_5CI_3$ is treated with excess of $AgNO_3$?

(a) 0.01

(b) 0.02

(c) 0.03

(d)None of these .

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16. 0.001 mol of $Cr(NH_3)_5(NO_3)(SO_4)$ was passed through a cation exchanger the acid coming out of it reguired $20mL$ of 0.1M NaoH for netralisation Hence the complex is

$[Cr(NH_3)_5SO_4]NO_3$

(b) $[Cr(NH_3)_5NO_3]SO_4$

(c) $[Cr(NH_3)_5](SO_4)(NO_3$

(d) $[Co(NH_3)_5Br]SO_4$.

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Ex 7.1 Objective (Isomerism)

1. Which of the following coordination compounds exhibits ionisation isomerism

(a) $\left[Cr\left(NH_3\right)_6\right]CI_3$

(b) $\left[Cr(en)_3CI_3\right]$

(c) $\left[Cr(en)_3\right]CI_3$

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

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2. Which of the following complex compounds exhibits cis-trans isomerism

(a) $\left[PtCI_2\left(NH_3\right)_2\right]$

(b) $\left[PdCI_2BrI\right]$

(c) $\left[Pt\left(NH_3\right)(py)(CI)(Br)\right]$

All ofh these .

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3. How many geometrical isomers are possible for the square planar complex $\left[Pt\left(NO_2\right)(py)\left(NH_3\right)\left(NH_2OH\right)\right]NO_2$

(a) `Four

(b) Five

(c) Eight

(d) Three .

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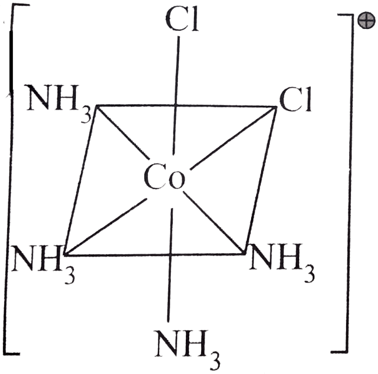
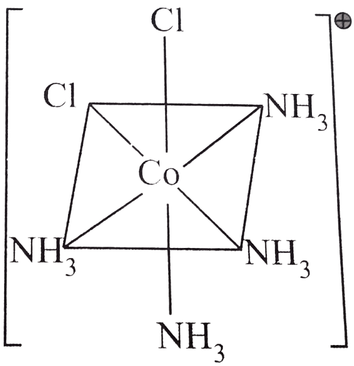
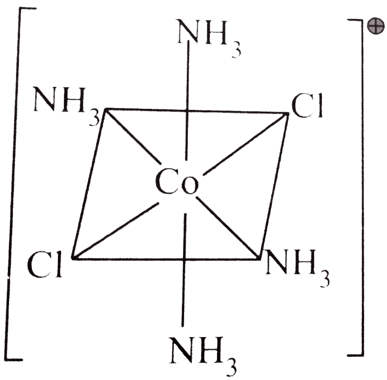
4. Consider the following spatial arrangements of the octahedral complex ion $\left[Co\left(NH_3\right)_4CI_2\right]^{\oplus}$



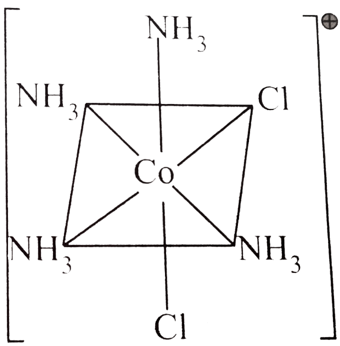
(I)



(II)



(III)



(IV)

Which of the following statements is incorrect regarding these structures?

A. I and II are enantiomers

B. II and III are cis and trans isomers respectively

C. III and IV are trans and cis isomers respectively

D. II and IV have identical structures

Answer: C

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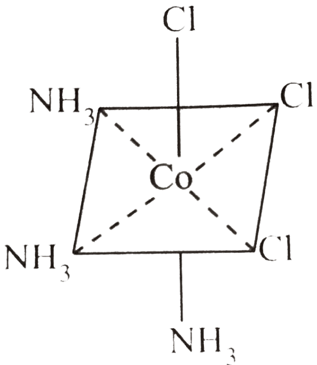
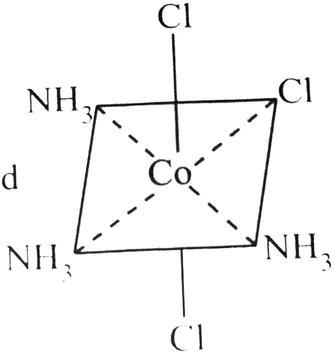
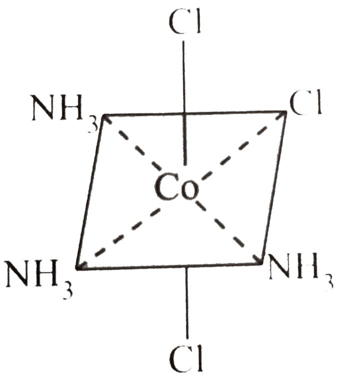
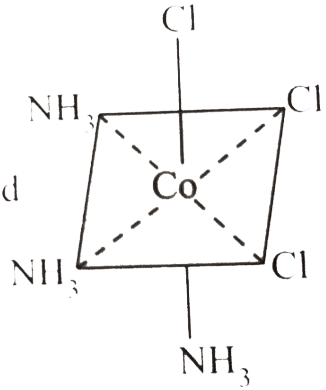
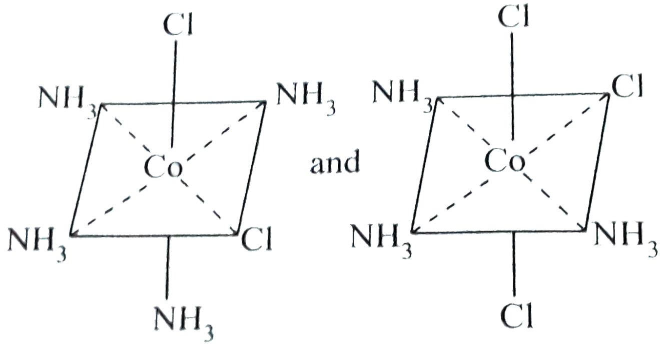
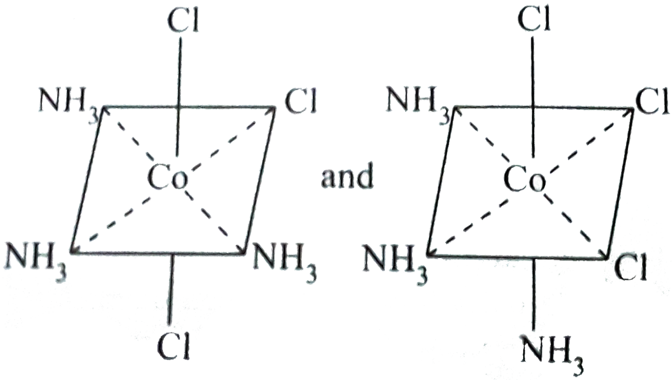
5. Which of the following pairs of structures represent facial and meridional isomers (geometrical isomers) respectively ?

a.  and 

b.  and 

c. 

d. 

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6. Which would exhibit coordination isomerism

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

(b) $\left[Cr(en)_2Cl_2\right]^{\oplus}$

(c) $\left[Cr\left(NH_3\right)_6\right]Cl_3$

$[Cr(edta)]^{-1}$.

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7. Which would exhibit ionisation isomerism

(a) $p\left[Co\left(NH_3\right)_6\right]\left[\left(C_2O_4\right)_3\right]$

(b) $\left[Co\left(NH_3\right)_5Br\right]^{2+}SO_4^{2-}$

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

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

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8. The water -soluble complex among the following is

(a) $\left[Ni(HDMG)_2\right]$

(b) $\left[Co\left(NH_3\right)_3CI_3\right]$

(c) $Ni(CO)_4$

$\left[Ni(HDMG)_2\right]CI_2$.

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9. Arrage the following optical activity possible in

(a) $\left[Co\left(H_2O\right)_2\left(NH_3\right)_3CI\right]^{\oplus}$

(b) $\left[Co\left(H_2O\right)\right)_4CI_2]^{\oplus}\Big]$

(c) $\left[Co\left(NH_3\right)_4\left(NO_2\right)CI\right]^{\oplus}$

(d) $\left[Co(CN)_5NC\right]^{\Theta}$.

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10. When an excess of ammonia solution is added to $CuSO_4$ which solution is formed

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

(b) $\left[Cu\left(NH_3\right)_4\right]^{\oplus}$

(c) $\left[Cu\left(NH_3\right)_2\right]^{\oplus}$

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

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11. Copper sulphate solution reacts with KCN to give

(a) $Cu(CN)_2$

(b) $CuCN$

(c) $K_2\left[Cu(CN)_4\right]$

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

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12. The ionisation isomer of $\left[Co\left(H_2O\right)_4CI_2NO\right.$

(a) $\left[Co\left(H_2O\right)_4\left(NO_2\right)\right]CI_2$

(b) $\left[Co\left(H_2O\right)_4CI_2\right]NO_2$

$\left[Co\left(H_2O\right)_4CI(ONO)\right]CI$

(d) $\left[Co\left(H_2O\right)_4CI_2\left(NO_2\right)\right]H_2O$.

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Ex 7.2 Subjective

1. One the basis of VBT answer the following complex ions

(i) $\left[Ti(bpy)_3\right]^{\Theta}$

(b) $\left[V\left(H_2O\right)_6\right]^{3+}$

(ii) $\left[V\left(H_2O\right)_6\right]^{3+}$

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

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

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

Type of hybridisation involed

(b) Type of inner or outer orbital octahedral complex

(c) Magnetic behaviour and $\mu_{s\pi n}$ value .

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2. Identify the complex which are coloured and which are colourless

Explain

$\left[Cr\left(NH_3\right)_5(NCS)\right]\left[ZnCI_4\right]$

(b) $\left[Ti\left(NO_3\right)_4\right]$

(c) $\left[Cu\left(NC - CH_3\right)_4\right]^{\oplus}BF_4^{\oplus}$

(d) $\left[Cr\left(NH_3\right)_6\right]^{3+}3CI^{\Theta}$

(e) $K_3\left[VF_6\right]$.

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3. Write the $IUPAC$ nomenclature of the given complex along with its hybridisation and structure

$Ca\left[Cr(NO)\left(NH_3\right)(CN)_4\right], \mu_{s\pi n} = 1.73BM$.

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4. On the basic of CET explaine the following complex of Co^{3+} like $\left[Co\left(NH_3\right)_6\right]^{3+}$, $\left[Co(en)_3\right]^{3+}$ and $\left[Co\left(NO_2\right)_6\right]^{3-}$ are diamagntic while $\left[CoF_6\right]^{3-}$ and $\left[Co\left(H_2O\right)_6\right]^{3+}$ are paramagnetic .

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Ex 7.2 Objective

1. The 0.0001 molal solution of a complex AB_{10} has the freezing point of $-0.0015\,^{\circ}C$ in water. Assuming $100\,\%$ dissociation of the complex, find the proper representation of the complex $\left[K_f\left(H_2O = 1.86Km^{-1}\right)\right]$

(a) $\left[AB_8\right]$

(b) $\left[AB_3\right]B_7$

(c) $\left[AB_7\right]B_3$

(d) $\left[AB_5\right]B_5$.

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2. Given the following data about the absorption maxium of several complex ions what is the order of Δ_0 for these ions? .

Compound	λ_{max}
I. $\left[CrCI_6\right]^{3-}$	758
II. $\left[Cr\left(NH_3\right)_6\right]^{3+}$	465
III. $\left[Cr\left(H_2O\right)_6\right]^{3+}$	694

(a) $\Delta_0 < \delta_0(II) < \Delta_0(III)$

(b) $\delta_0(II) < \Delta_0(III) < \Delta_0(III)$

(c) $\Delta(0) < \delta_0(III) < \Delta_0(II)$

(d) $\Delta_0(III) < \Delta_0(II) < \Delta_0(I)$.

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3. Predict the order of $\Delta_0$for the following compounds

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

(II) $\left[Fe(CN)_2\left(H_2O\right)\right)_4\right]$

(III) $\left[fe(CN)_4\left(H_2O\right)\right)_2]^{2-}$

(a) $\delta_0 < \Delta_0(II) < \delta_0(III)$

(b) $\delta_0 < \Delta_0(I) < \delta_0(III)$

(c) $\delta_0 < \Delta_0(III) < \delta_0(II) < \Delta_0(I)$

$\delta_0 < \Delta_0(II) < \delta_0(III) < \Delta_0(I)$.

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4. from the information given in the passage what is the most likely configuration of the cobalt d-electrons for the species $(A)\ CoCl_6^{3-}$ and $(B) Co\left(No_2\right)_6^{3-}$?

(a) both (A) and (B)$haslowsπn(b) \perp h$(A) and (B) has low spin (c) both (A) and (B)$haslowsπn(d) \perp h$(A) and (B) has low spin .

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5. The hybrisation states of the central atom ion in the complex ions $\left[FeF_6\right]^{3-}, \left[Fe\left(H_2O\right)\right)_6]^{3+}$ and $\left[Ni\left(NH_3\right)_6\right]^{2+}$ are

(a) sp^3d^2, dsp^2 and d^4s^2 respectively

(b) all $3d^24s4p^3$

(c) all $4s4p^3 4d^2$

(d) sp^3d^2, dsp^3 and p^4d^2 respectively .

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6. Among $(A)\ TiF_6^{2-}$, $(B) CoF_6^{3-}$, $(C) Cu_2CI_2$ and$(D) NiCI_4^2$

(atomic number of $Ti = 22$, $Co = 27$, $Cu = 29$, $Ni = 28$) the colourless

species are

(a) (B) and (D)

(b) (A) and (B)

C and (D)(A) and (C)\` .

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7. The magnetic moment of a complex ion is $2.83 BM$ The complex ion

is

$\left[Cr\left(H_2\right)O\right)_6]^{3+}$

(b) $\left[Cu(CN)_6\right]^{2-}$

(c) $\left[V\left(H_2O\right)\right)_6]^{3+}$

(d) $\left[MnCI_4\right]^{2-}$.

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8. Which of the following statements is not true of the reaction given below

$$[Cu(H_2O)_6]^{2+} + 4NH_3 \rightleftharpoons [Cu(NH_3)_4]^{2+} + 4H_2O$$

(a) it is a ligand -substition reaction

(b) NH_3 is a relatively strong-field ligand while H_2O is a weak field ligand

(c) During the reaction there is a change in colour from light blue to dark blue

(d) $\left[Cu\left(NH_3\right)_4\right]^{2+}$ has a tetrahedral structure and is paramagnetic .

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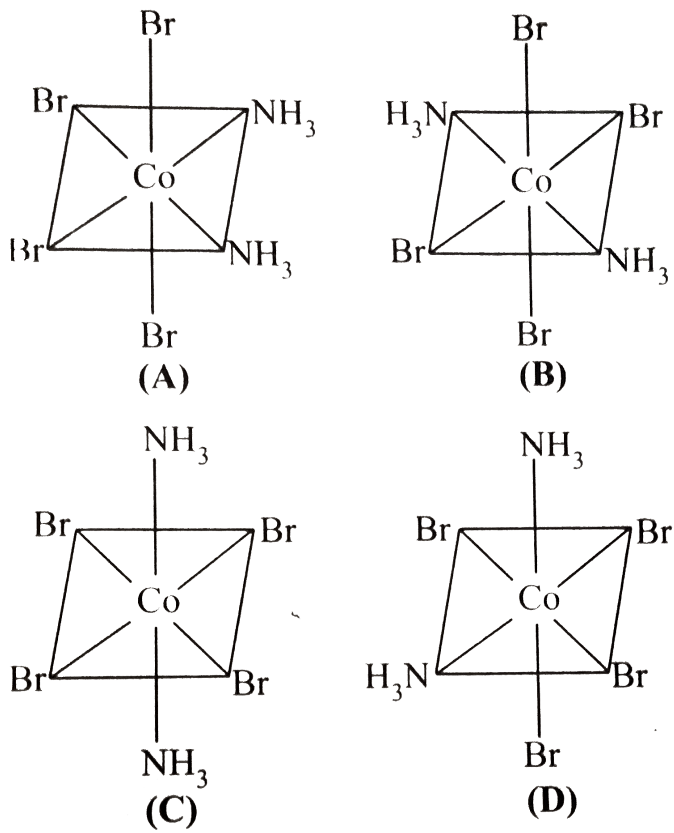
Exercises Linked Comprehension

1. Consider to following isomers of $\left[Co\left(NH_3\right)_2Br_4\right]^{\Theta}$ and answer the questions



Select the correct statement .

A. (a)Pairs of A and D are same and pairs of B and C are also same .

B. (b)All have chiral centres .

C. (c)B and D are enantiomers

D. (d)B and C are enantiomers

Answer: a

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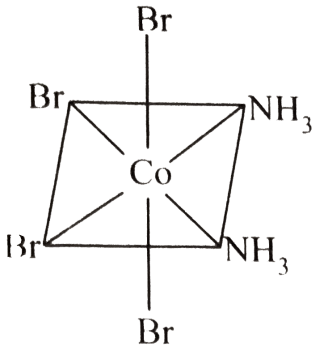
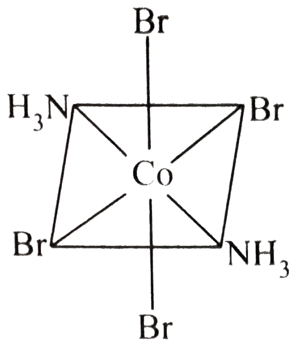
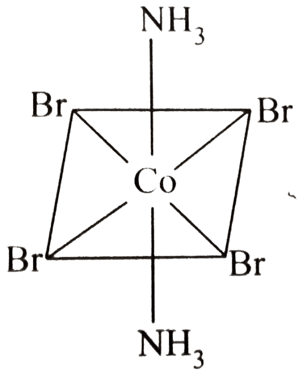
2. Consider to following isomers of $\left[Co\left(NH_3\right)_2Br_4\right]^{\Theta}$ and answer the questions



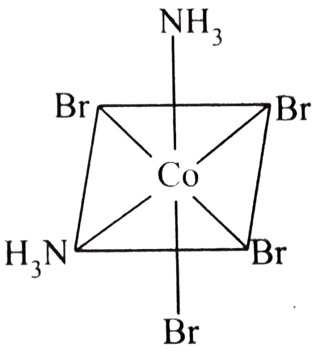
(A)



(B)



(C)



(D)

Select the correct statement .

A. $A$and D are trans and B and C are cis.

B. A and D are cis and B and C are trans

C. A and B are cis and C and D are trans

D. A and B are trans and C and D are is

Answer: B

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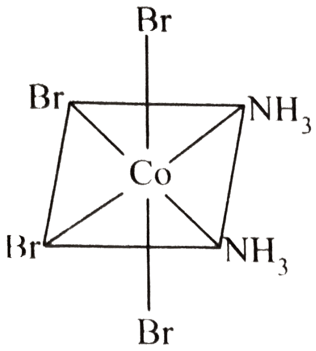
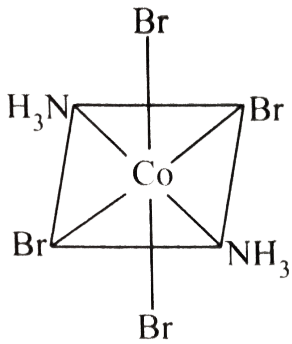
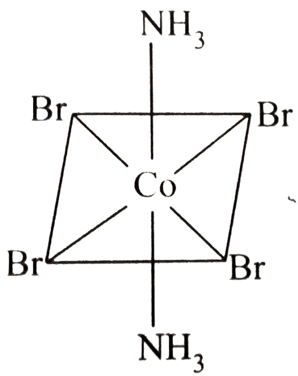
3. Consider to following isomers of $\left[Co(NH_3)_2Br_4\right]^{\ominus}$ and answer the questions



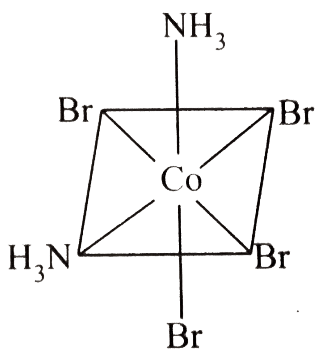
(A)



(B)



(C)



(D)

Select the correct statement .

A. Threre is chirality

B. There is geometrical isomerism

C. Both(a) and(b)

D. None of these

Answer: B

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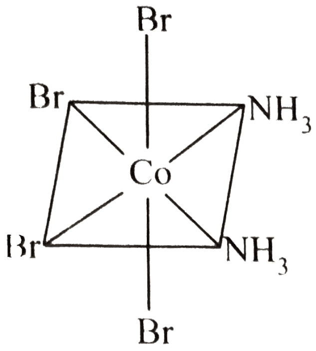
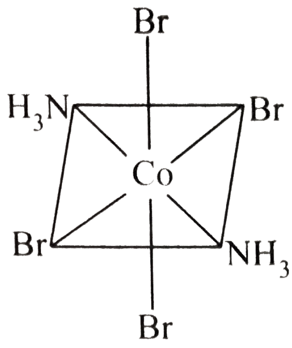
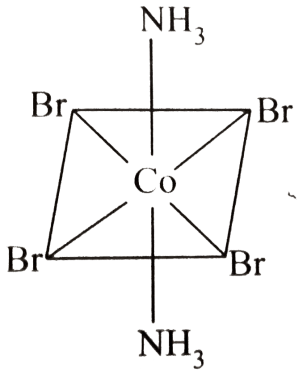
4. Consider to following isomers of $\left[Co\left(NH_3\right)_2Br_4\right]^{\Theta}$ and answer the questions



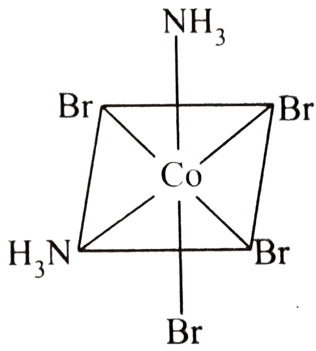
(A)



(B)



(C)



(D)

If $PQRS$ are four different ligands then how many geometric isomers will be found for square planar $[PtPQRS]^{2+}$.

A. 1

B. 2

C. 3

D. 4

Answer: C

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5. Consider the following experiments and answer the questions at the end of it

(A) When $Fe(CN)_2$ solution is treated with KCN solution species formed no longer gives tests of Fe^{2+} and $CN^{\ominus}$

(B) When K_2SO_4 solution is treated with $A1_2(SO_4)_3$ solution species formed gives tests of $K^{\oplus}$, $A1^{3+}$ and SO_4^{2-}

Species formed in experiment A does not give test of Fe^{2+} and $CN^{\ominus}$ it is due to formation of .

A. $K_2[Fe(CN)_4]$

B. $K_3[Fe(CN)_5]$

C. $K_3[Fe(CN)_6]$

D. $K_4[Fe(CN)_6]$

Answer: D

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6. Consider the following experiments and answer the questions at the end of it

(A) When $Fe(CN)_2$ solution is treated with KCN solution species formed no longer gives tests of Fe^{2+} and CN^{Θ}

(B) When K_2SO_4 solution is treated with $A1_2(SO_4)_3$ solution species formed gives tests of $K^{\oplus}$, $A1^{3+}$ and SO_4^{2-}

Species formed in experiment (B) is .

A. Complex

B. Double salt

C. Liquid crystal

D. None of these

Answer: B

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7. Consider the following experiments and answer the questions at the end of it

(A) When $Fe(CN)_2$ solution is treated with KCN solution species formed no longer gives tests of Fe^{2+} and CN^{Θ}

(B) When K_2SO_4 solution is treated with $A1_2(SO_4)_3$ solution species formed gives tests of $K^{\oplus}$, $A1^{3+}$ and SO_4^{2-}

EAN of iron formed in (A) is .

A. 26

B. 24

C. 36

D. 38

Answer: C

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8. Consider the following experiments and answer the questions at the end of it

(A) When $Fe(CN)_2$ solution is treated with KCN solution species formed no longer gives tests of Fe^{2+} and $CN^{\ominus}$

(B) When K_2SO_4 solution is treated with $A1_2(SO_4)_3$ solution species formed gives tests of $K^{\oplus}$,A1^(3+) and SO_(4)^(2-) $Whenthespeciesf$ or $med \in$ $AistreatedwithFeCI\_(3)`a$ bule colour is obtained It is due to formation of .

A. $Fe^{II}\left[Fe^{III}(CN)_6\right)]^{\ominus}$

B. $Fe^{II}\left[Fe^{III}(CN)_6\right)]^{\ominus}$

C. Both(a)and(b)

D. None of these

Answer: C

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9. Two research students were instruced intructed to synthesise the complex

$$\left[Co\left(NH_3\right)_5\left(NO_2\right)\right]Br_2$$

They synthesised the complexes with identical molecular formula molar mass geometry conductane and spin but they differed in colour Based on the above facts answer the following questions

The difference in colour is due to

A. optical isomerism

B. geometrical isomerism

C. linkage isomerism

D. nuclear isomerism

Answer: C

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10. Two research students were instruced intructed to synthesise the complex

$$\left[Co\left(NH_3\right)_5\left(NO_2\right)\right]Br_2$$

They synthesised the complexes with identical molecular formula molar mass geometry conductane and spin but they differed in colour Based on the above facts answer the following questions

Which of the ligands can show ambidentate property ?

A. NO_2^{Θ}

B. NH_3

C. H_2O

D. $CO_{3^{2-}}$

Answer: A

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11. Two research students were instruced intructed to synthesise the complex

$$\left[Co\left(NH_3\right)_5\left(NO_2\right)\right]Br_2$$

They synthesised the complexes with identical molecular formula molar mass geometry conductane and spin but they differed in colour Based on the above facts answer the following questions

Complexes synthesised can be

(i) $\left[Cr\left(NH_3\right)_5\left(NO_2\right)Br_2\right.$,(ii) $\left[Cr\left(NH_3\right)_5(ONO)\right]Br_2$

(iii) $\left[Cr\left(NH_3\right)_5Br_2\right]NO_2$ (iv) All of these .

A. Both(i) and (ii)

B. Both(i) and(iii)

C. Both(ii)and(iii)

D. All of these

Answer: A

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12. One cationic complex has to isomers A and B Each has one Co^{3+} five NH_3 one CI^{Θ} and one SO_4^{2-} stoichiometically A give white precipitate with $BaCI_2$ white B gives white precipitate with $AgNO_3$ A can be .

A. $\left[Co\left(NH_3\right)_5\right]CISO_4$

B. $\left[Co\left(NH_3\right)_5SO_4\right]CI$

C. $\left[Co\left(NH_3\right)_5CI\right]SO_4$

D. $\left[Co\left(NH_3\right)_4SO_4\right]CI.\ NH_3$

Answer: C

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13. One cationic complex has to isomers A and B Each has one Co^{3+} five NH_3 one CI^{Θ} and one SO_4^{2-} stoichiometically A give white precipitate with $BaCI_2$ white B gives white precipitate with $AgNO_3$ (B) can be .

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

B. $\left[CO\left(NH_3\right)_5CI\right]SO_4$

C. $\left[Co\left(NH_3\right)_3CI\left(SO_4\right)\right]2NH_3$

D. None of these

Answer: A

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14. Complexes A and B have similarity in the following but not in .

A. (a)Molar conductane

B. (b)Van't Hoff factor

C. (c)EAN

D. (d)Colour

Answer: D

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15. Velence bond theroy describes the bonding in complexs in terms of coordinate -covalent bond resulting from overlap filled ligand orbitals with vacant metal hybrid orbitals This theory explains magnetic behaviour and geometrical shape of coordination compounds Magnetic moment of a complex compound can be determined experimentally and theoretically by using spin only formula

Magnetic moment $\sqrt{n}(n+2)BM$ (where n = No. unpaired electrons) .

The value of of spin only magnetic moment for octahedral complex of the following configuration is $2.84BM$ The correct statement is

(a) d^4 (in weak field ligand)

(b) d^2 (in weak field and in strong field ligand)

(c) d^3 (in weak field and in strong field ligand)

(d) d^5 (in strong field ligand) .

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16. Velence bond theroy describes the bonding in complexs in terms of coordinate -covalent bond resulting from overlap filled ligand orbitals with vacant metal hybrid orbitals This theory explains magnetic behaviour and geometrical shape of coordination compounds Magnetic moment of a complex compound can be determined experimentally and theoretically by using spin only formula

Magnetic moment $\sqrt{n}(n+2)BM$ (where n = No. unpaired electrons) . Ni^{2+} cation combines with a uninegative monodentate ligand X^{Θ} to form paramagnetic complex $[NiCI_4]^{2-}$ The number of unpaired electrons(s) in central metal cation and geometry of this complex respectively are

(a) One,tetrahedral

(b) Two,tetrahedral

(c) One,square planar

(d) Two, square planar .

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17. Square planar complexes are formed by d^8 ions with strong field ligands The crystal field splitting Δ_0 is larger for the second and theird row transition elements and for more highly charged species All the complexes having $4d^8$ and $5d^8$ configurations are mostly square planar including those with weak field ligands such as halide ions square planar complexes can show geometrical isomerism but they do not show optical isomerism due to the presence of plane of symmetry

Which of the following molecule has synergic bonding?

(a) $\left[Fe\left(\pi - C_5H_5\right)_2\right]$

(b) $\left[RhCI\left(PPh_3\right)_3\right]^{3+}$

(c) $\left[Fe(Phen)_3\right]^{3+}$

(d) All are having synergic bonding .

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18. Square planar complexes are formed by d^8 ions with strong field ligands The crystal field splitting Δ_0 is larger for the second and theird row transition elements and for more highly charged species All the complexes having $4d^8$ and $5d^8$ configurations are mostly square planar including those with weak field ligands such as halide ions square planar complexes can show geometrical isomerism but they do not show optical isomerism due to the presence of plane of symmetry

Among the following complexes which has a square planar geometry?

(a) $\left[RhCI(CO)\left(PPh_3\right)_2\right]$

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

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

(d) $K_2\left[Zn(CN)_4\right]$.

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19. Square planar complexes are formed by d^8 ions with strong field ligands The crystal field splitting Δ_0 is larger for the second and theird row transition elements and for more highly charged species All the complexes having $4d^8$ and $5d^8$ configurations are mostly square planar including those with weak field ligands such as halide ions square planar complexes can show geometrical isomerism but they do not show optical isomerism due to the presence of plane of symmetry

(a) All are low spin complexes

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

(c) $\left[Pt\left(NH_3\right)_4\right]^{2+}$

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

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20. If in the mixed carbonyl the other ligand is also π acceptor it would compete with the ligand CO for gaining the metal d_{π} electron charge The higher is the extent of back donation in CO , the lesser will be the stretching vibration frequency for C - O bond If PP_3 is better pi-acceptor than CO then answer the following

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) $I < II < III$.

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21. If in the mixed carbonyl the other ligand is also π acceptor it would compete with the ligand CO for gaining the metal d_π electron charge The higher is the extent of back donation in CO , the lesser will be the stretching vibration frequency for C - O bond If PP_3 is better pi-acceptor than CO then answer the following

Select the correct order of stretaching vibration frequency C - O bond in following molecules

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

(II) $\left[Ni\left(PF_3\right)(CO)_3\right]$

(a) $I = II$

$I < II$

(c) $I = II$

(d) cannot be predicated .

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22. If in the mixed carbonyl the other ligand is also π acceptor it would compete with the ligand CO for gaining the metal d_{π} electron charge The higher is the extent of back donation in CO , the lesser will be the stretching vibration frequency for C - O bond If PP_3 is better pi-acceptor than CO then answer the following

Select the correct order of C - O bond length in the following molecules .

(I) $\left[Mo(CO)_3\left(PF_3\right)_3\right]$ (II) $\left[Mo(CO)_3\left(PCI_3\right)_3\right]$

(III) $\left[Mo(CO)_3\left(P(Me)_{3\,-}\,(3)\right]$

(a) $I > II > III$

(b) $III > I > II$

(c) $II > III > I$

(d) $I < II < III$

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23. Most of the metal carbonyls obey inert gas rule which states the the compounds in which the central metal atom appears to have attained the configuration of a noble gas either by the sharing or by the transfer of electrons tend to be more stable .

Which of the following has lowest C - O bond order?

(a) $\left[Mn(CO)_6\right]^{\oplus}$

(b) $\left[Co(CO)_4\right]^{\oplus}$

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

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

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24. If in the mixed carbonyl the other ligand is also π acceptor it would compete with the ligand CO for gaining the metal d_{π} electron charge The higher is the extent of back donation in CO , the lesser will be the stretching vibration frequency for C - O bond If PP_3 is better pi-acceptor than CO then answer the following

Select the correct order of C - O bond length in the following molecules .

(I) $\left[Mo(CO)_3\left(PF_3\right)_3\right]$ (II) $\left[Mo(CO)_3\left(PCI_3\right)_3\right]$

(III) $\left[Mo(CO)_3\left(P(Me)_3\right)\right]$

(a) $I > II > III$

(b) $III > I > II$

(c) $II > III > I$

(d) $I < II < III$

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25. Most of the metal carbonyls obey inert gas rule which states the the compounds in which the central metal atom appears to have attained the configuration of a noble gas either by the sharing or by the transfer of electrons tend to be more stable

Which of the following has highest C - O bond length ?

(a) $\left[mn(CO)_6\right]^{\oplus}$

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

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

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

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26. In the manufacture of ions a gas (A) is formed in the zone of combustion of the blast furnace The gad (A) formed in the zone of combustion of the blast furnace. The gas (A) reacted with coke in the zone of fusion to from another gas (B). X moles of (B) reacts with iron at $200\ ^{\circ}C$ and 100 atm pressure to form a compounds (C)

The d orbital (s) involved in the formation of the complex (C) will be

(a) d_z2

(d) d_(xy) and d_(x)2-y2$(c)d_x2$ - $y2$ and d_z2

(d) d_x2 -$_y2$.

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27. In the manufacture of ions a gas (A) is formed in the zone of combustion of the blast furnace The gad (A) formed in the zone of combustion of the blast furnace. The gas (A) reacted with coke in the zone of fusion to from another gas (B). X moles of (B) reacts with iron at $200\ ^\circ C$ and 100 atm pressure to form a compounds (C) will be

The magnetic moment and effective atomic number of the C repectively, are

(a) 4.93 and 36

(b) 0 and 34

(c) 0 and 36`

(d) None .

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28. The π acceptor ligands are those which possess vacant π - orbitals in addition to the lone pairs of electrons

Which of the following complex ion has lowest M - C bond length?

(a) $\left[V(CO)_6\right]^{\oplus}$

(b) $\left[Mn(CO)_6\right]^{\oplus}$

(c) $Ni(CO)_4$

(d) $Fe(CO)_5$.

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29. The π acceptor ligands are those which possess vacant π - orbitals in addition to the lone pairs of electrons

Which of the following complex ion has the highest C - O bond length ?

(a) $\left[V(CO)_6\right]^{\oplus}$

(b) $Ni(CO)_4$

(c) $Fe(CO)_5$

(d) $\left[Mn(CO)_6\right]^{\oplus}$.

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30. The π acceptor ligands are those which possess vacant π - orbitals in addition to the lone pairs of electrons

Which of the following complex// ion has lowest C - O bond order?

(a) $\left[V(CO)_6\right]^{\oplus}$

(b) $Ni(CO)_4$

(c) $Fe(CO)_5$

(d) $\left[Mn(CO)_6\right]^{\oplus}$.

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31. The π acceptor ligands are those which possess vacant π - orbitals in addition to the lone pairs of electrons

Which of the following complex// ion has lowest M - C bond order?

(a) $\left[V(CO)_6\right]^{\oplus}$

(b) $Ni(CO)_4$

(c) $Fe(CO)_5$

(d) $\left[Mn(CO)_6\right]^{\oplus}$.

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32. The pi acid ligands donate their lone pairs to the metal to form a normal o bond with the latter in addition to it the vacant orbitals accepct electrons from the filled mental orbitals to form a type of pi bonand which suppliments the o bond

Which of the following has lowest M - C bond lenght?

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

(b) $\left[Mn(CO)_6\right]^{\oplus}$

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

(d) $\left[Co(CO)_4\right]^{\Theta}$.

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33. The pi acid ligands donate their lone pairs to the metal to form a normal o bond with the latter in addition to it the vacant orbitals accepct electrons from the filled mental orbitals to form a type of pi bonand which suppliments the o bond

Which of the following has lowest $M - C$ bond lenght?

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

(b) $\left[Co(CO)_4\right]^{\Theta}$

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

(d) $\left[Mn(CO)_6\right]^{\oplus}$.

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34. The pi acid ligands donate their lone pairs to the metal to form a normal o bond with the latter in addition to it the vacant orbitals accepct electrons from the filled mental orbitals to form a type of pi bonand which suppliments the o bond

Which of the following has lowest C - O bond lenght?

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

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

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

(d) $\left[Mn(CO)_6\right]^{\oplus}$.

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35. Coordination compounds plays many important roles in animals and plants. The are essential in the storage and transport of oxygen as electrons transfer agents as catalysts and in photosynthesis Wide range of application in daily life takes place through formation of complexes Photographic fixing qualitative and quantitative analysis purification of water metallurgical extraction are some specific worth mentioning

The complex $\left[Fe\left(H_2O\right)_5NO\right]^{2+}$ is formed in the brown ring test for nitrates when freshly prepared $FeSO_4$ soultion is added to aqueous solution of $NO_3^{\ominus}$ followed by addition of conc. H_2SO_4 Select correct statement about this complex

(a) Colour change is due to charge transfer

(b) It has iron in $+1$ oxidation state and nitrosyl as $NO^{\oplus}$

(c) It has magnetic moment of $3.87BM$ confirming three unpaired electrons in Fe

(a) All the above are correct statements .

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36. Coordination compounds plays many important roles in animals and plants. The are essential in the storage and transport of oxygen as electrons transfer agents as catalysts and in photosynthesis Wide range of application in daily life takes place through formation of complexes Photographic fixing qualitative and quantitative analysis purification of water metallurgical extraction are some specific worth mentioning

Extraction of Ag from sulphide ore and removal of unreacted silver from photographic plate involve complexes:

(a) $\left[Ag\left(S_2O_3\right)_2\right]^{3-}$ ion both

(b) $\left[Ag(CN)_2\right]^{\Theta}$ in both

(c) $\left[Ag\left(S_2O_3\right)\right]^{3-}$, $\left[Ag(CN)_2\right]^{\Theta}$

(d) $\left[Ag(CN)_2\right]^{\Theta}$,[Ag_(2)(S_(2)O_(3))_(2)]^(3-)` .

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37. Coordination compounds plays many important roles in animals and plants. The are essential in the storage and transport of oxygen as electrons transfer agents as catalysts and in photosynthesis Wide range of application in daily life takes place through formation of complexes Photographic fixing qualitative and quantitative analysis purification of water metallurgical extraction are some specific worth mentioning

Lead poisoning in the body can be removed by

(a) $EDTA$ in the form of calcium dthydrogen salt

(b) Cis-platin

(c) Zeisse' s salt

(d) DMG .

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38. Coordination compounds plays many important roles in animals and plants. The are essential in the storage and transport of oxygen as electrons transfer agents as catalysts and in photosynthesis Wide range of application in daily life takes place through formation of complexes Photographic fixing qualitative and quantitative analysis purification of water metallurgical extraction are some specific worth mentioning

Cu^{2+} and Cd^{2+} both are precipitated as sulphides on passing H_2S gas in dil HCI medium However, precipitation of Cu^{2+} is prevented by

(a) Adding excess of $K_4[Fe(CN)_6]$ when Cd^{2+} is only precipitated

(b) Adding excess of KNC when Cu^{2+} for stable complex $[Cu(CN)_4]^{3-}$ and Cd^{2+} forms unstable complex $[Cd(CN)_4]^{2-}$

(c) All of the above

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39. Coordination compounds plays many important roles in animals and plants. The are essential in the storage and transport of oxygen as electrons transfer agents as catalysts and in photosynthesis Wide range of application in daily life takes place through formation of complexes Photographic fixing qualitative and quantitative analysis purification of water metallurgical extraction are some specific worth mentioning

Arrange of the following in order of decreasing number of unpaired electrons

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

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

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

(IV) $\left[fe\left(H_2O\right)_6\right]^{3+}$

(a) IV,I,II,III

(b) I, II, III, IV

(c) III, II, IIV

(d) II,III,I,IV` .

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Exercises Multiple Correct(Naming And Terminology)

1. Selcet the correct statement(s) for double salt .

A. Double salts are stable in solid state but lose their identity in aqueous solution .

B. In double salt the properties of constituent ions are not changed in their aqueous solution .

C. Double salts are stable in solid state and do not lose their identity in aqueous solution .

D. In double salt the properties of constituent ions are changed in their aqueous solution .

Answer: A::B

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2. Which of the following ligand (s) is/are ambidentate ?

A. $NOS^{\ominus}$

B. $SCN^{\ominus}$

C. $NO_2^{\ominus}$

D. $CH_3COO^{\ominus}$

Answer: A::B::C

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3. Select the correct $IUPA$ name for $\left[CoCI_2(en)_2\right]_2\left(CIO_3\right)_2$.

A. Dichloridobis (ethylenediamine)cobalt(III)chlorate .

B. Dichloridobis (ethane-1,2-diamine)cobalt(III)chlorate .

C. bis{dichloridoethylenediaminecobalt(III)}chlorate

D. bis{di(chlorido)ethylenediaminecobalt(III)}chlorate

Answer: A::B

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4. Bidentate ligands are

A. $C_2O_4^{2-}$ (oxalate)

B. en(ethylenediamine)

C. DMG(dimethyl glyoxime)

D. Gly (glycine)

Answer: A::B::C::D

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5. Which of the following complex (s) is/are having correct name ?

A. $Cs\left[Pt\left(NH_3\right)I_5\right]$ Ceasium amminepentaiodidoplatirate(IV)

B. $\left[Ag(CN)_2\right]^{\Theta}$ Dicyanidoargentate(I)ion

C. $\left[Rb_3\left[Cr\left(C_2O_4\right)_3\right]\right.$ -Rubidium trioxalatochromate(III)

D. $K_2[Ni(EDTA)]$ Potassium ethylenediaminetetraacetatonickel(II)

Answer: A::B::C

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6. Which can form chelates?

A. Ethylene diamine

B. Oxalate

C. Glycinate

D. Cyanide

Answer: A::B::C

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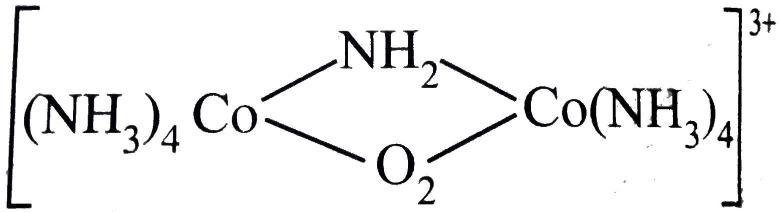
7. Select the correct $IUPA$ name for the following



A. Tetramminecobalt(III)muamido-mu-peroxidotetraamm

inedicobalt(III) ion

B. mu-Amido-mu-peroxidobis(tetraammine)dicobalt-(III)ion

C. mu-Amido-mu-peroxidobis(tetraamminecobalt(III))ion

D. mu-Amido-mu-peroxidobis(tetraamminecobalt(III))ion

Answer: A::B::C::D

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8. 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 neutral molecules .

C. Species which show primary valencies in a complex compound can be precipitated out .

D. None of these

Answer: A::B::C

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9. Which of the following complex(s)is//are an example of homolepic complex .

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

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

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

D. $d)\left[Ni\left(NH_3\right)_4CI_2\right]$

Answer: A::B::C

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Exercises Multiple Correct(Isomerism)

1. Which of the following molecules$(s) is/are$ not showing optical isomerism ? .

A. $a.\ \left[Co\left(NH_3\right)_3Cl\right]^{\oplus}$

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

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

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

Answer: A::B::C

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2. Which of the following complex ion(s) is//are not expected to sbsorb visible light?

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

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

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

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

Answer: A::C::D

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3. Coordination compounds plays many important roles in animals and plants. The are essential in the storage and transport of oxygen as electrons transfer agents as catalysts and in photosynthesis Wide range of application in daily life takes place through formation of complexes Photographic fixing qualitative and quantitative analysis purification of water metallurgical extraction are some specific worth mentioning

The complex $\left[Fe\left(H_2O\right)_5NO\right]^{2+}$ is formed in the brown ring test for nitrates when freshly prepared $FeSO_4$ soultion is added to aqueous solution of $NO_3^{\ominus}$ followed by addition of conc. H_2SO_4 Select correct statement about this complex

(a) Colour change is due to charge transfer

(b) It has iron in $+1$ oxidation state and nitrosyl as $NO^{\oplus}$

(c) It has magnetic moment of $3.87BM$ confirming three unpaired electrons in Fe

(a) All the above are correct statements .

A. Colour change is due to charge transfer .

B. It has iron in $+1$ oxidation state and nitrosyl as $NO^{\oplus}$.

C. It has magnetic moment of $3.87BM$ confirming three unpaired electrons in Fe .

D. In complex Fe has d^2sp^3 hybridisation .

Answer: A::B::C

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4. Which of the following represent the correct sequence of indicated property ? .

A. $a. Mn^{2+} < Ni^{2+} < Co^{2+} < Fe^{2+}$: magnetic moment

B. $b. FeO > CoO > NiO$:basic character

C. $c. Sc < Ti < Cr < Mn$: number of oxidation states

D. $d.1.73\mu$: one unpaired electrons

Answer: B::C::D

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5. Which of the following complexes diamagnetic:

A. $[AuI_4]^{\Theta}$

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

C. $[CoI_6]^{3-}$

D. $[Co(CO)_4]^{\Theta}$

Answer: A::D

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6. Which of the following molecules$(s)is/are$ not showing optical isomerism ? .

A. $a.\ \left[Co\left(NH_3\right)_3Br_3\right]$

B. $b.\ \left[Co(en)Br_2\left(NH_3\right)_2\right]^{\oplus}$

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

D. $d.\ \left[Co(en)_2Br_2\right]^{\oplus}$

Answer: B::C::D

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7. Both geometrical and optical isomerisms are not shown by

A. a.dibromidobis (ethylenediamine)cobalt(III)ion

B. b.tetraamminedibromido cobalt(III)ion

C. c.tetraamminedibromido cobalt(III) ion

D. d.trioxalatochromate(III)ion

Answer: B::C::D

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8. Which of the following statement(s) is//are correct?

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

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

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

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

Answer: A::B::C

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9. In Which case gemetrical isomer cis is possible with M as metal ion if complexes are square planar having $CN = 4$?

A. $a.\ MX_2Y_2$

B. $b.\ MX_2YZ$

C. $c.\ MXY_2Z$

D. $d.\ MX_4$

Answer: A::B::C

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10. $d_{x}2 -_{y}2$ orbital is involved in which of the following hybridisation ?

A. $a. sp^3d^3$

B. $b. dsp^2$

C. $c. sp^3d^2$

D. $d. sp^3d$

Answer: B::C

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Exercises Multiple Correct (Hybridisation , Vbt , Cft)

1. A d-block element forms octahedral complex but its spin magnetic moment remains same either in strong field or in weak field ligand Which pf the following is//are correct ?

A. a.Element always forms colourless comound

B. b.Number of electrons in t_{2g} orbitals are higher than in e_g orbitals

C. c.It can have either d^3 or d^8 configuration.

D. d.It can have either d^7 or d^8 configuration

Answer: B::C

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2. Which of the following is//are characteristic of a tetrahedral complex ?

A. $a.\ d_x2\ \text{-}_y2$ and d_z2 orbitals are low energy orbitals

B. b.Most tetrahedral complexes are high spin

C. c.Crystal field splitting is found double in octahedral complexes

.

D. d.Splitting pattern in tetrahedral complex is just opposite of that in octahedral complexes.

Answer: A::B::D

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3. The complex $K_4\left[Zn(CN)_4\left(O_2\right)_2\right]$ is oxidised into $K_2\left[Zn(CN)_4\left(O_2\right)\right]$, then whichof the following is//are correct:

A. a.Zn(II) is oxidised to Zn(IV)

B. b.magnetic moment decreases

C. c.O - O bond length decreases

D. d.magnetic moment remains same.

Answer: C::D

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4. Select the correct statement:

A. a. $\left[Co\left(H_2O\right)_6\right]^{3+}$ is Co(III), low spin, 0 unpaired electrons diamagnetic .

B. b. $\left[CoF_6\right]^{3-}$ is Co(III), high spin $d^6, 4$ unpaired electron paramagnetic.

C. c. $\left[RhF_6\right]^{3-}$ is $Rh(III)$ low spin $d^6, 0$ unpaired eletrons diamagnetic .

D. d. $\left[Fe(CN)_6\right]^{4-}$ high spin $d^6, 0$ unpaired electron dimagentic .

Answer: A::C::D

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

A. a.High spin complex

B. b.Having d^2sp^3-hybridization

C. c.Low spin complex

D. d.Having octahedral structure .

Answer: B::C::D

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6. Colourless tetrahedral complexes among the following are

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

B. b.$Ca\left[NiCI_4\right]$

C. c.$Na\left[BF_4\right]$

D. d.$Ni(CO)_4$

Answer: A::C::D

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Exercises Multiple Correct(Application Of Coordination Compounds)

1. The coordination number of a central metal atom in a complex(s) is//are not determined by

A. a.The number of anionic ligands bonded to the metal ion

B. b.The number of ligands around metal ion bonded by pi-bonds

C. c.The number of ligands around a metal ion bonded by both pi and o-bonds

D. d.The number of ligands around a metal ion bonded by o-bonds

Answer: A::B::C

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2. Which of the folowing statement (s) is//are incorrect?

A. Metal carbonyls are the examples of only o-boned organometallic complexes

B. Metal carbonyls are the examples of only o-boned organometallic complexes

C. Metal carbonyls are the examples of only o-boned organometallic complexes which involve both o and pi-bonds between metal and carbon of the carbonyl group .

D. Metal carbonyls involve both o and π bonds between metal and oxygen of the carbonyl group .

Answer: A::B::D

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3. Which of the folowing is an example of π boneded organometallic complex ?

A. Ferrocene

B. Dibenzenechromium

C. $Zn(C_2H_5)_2$

D. $Pb(C_2H_5)_4$

Answer: A::B

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4. Which of the following is/are example (s) of σ-bonded organometallic compound?

A. $Al_2\left(CH_3\right)_6$

B. $Pb\left(CH_3\right)_4$

C. $Zn\left(C_2H_5\right)_2$

D. Ferrocene

Answer: A::B::C

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5. Which of the following statement is correct regarding metal carbonyl ?

A. a.In $Mn_2(CO)_{10}$ bond order of Mn - Mn is 0 .

B. b.In $Fe_2(CO)_9$ number of Fe - Fe bonds is 1

C. c.In $Ni(CO)_4$ all bond length are same

D. d.$Fe(CO)_5$ is diamagnetic

Answer: B::C::D

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6. Select correct statements:

A. a.$\left[Ni(en)_3\right]^{2+}$ is less stable than $\left[Ni\left(NH_3\right)_6\right]^{2+}$

B. b.Increase in stability of the complexes due to the presence of multidentate cyclic ligand is called macro-cyclic effect .

C. c.$\left[Ni(en)_3\right]^{2+}$ is more stable than $\left[Ni\left(NH_3\right)_6\right]^{2+}$

D. d.For a given ion and ligand the greater the charge on the metal ion the greater is the stability

Answer: B::C::D

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7. IN which of the following cases the synergic bonding takes place at the pi orbital of the ligand .

A. $\left[PtCI_3\left(C_2H_4\right)\right]^{\Theta}$

B. $\left[Ni\left(PF_3\right)_4\right]$

C. $Cr\left[\left(C_6H_6\right)_2\right]$

D. $Fe\left[\left(\pi\text{ - }C_5H_5\right)_2\right]$

Answer: A::B::C

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8. Which of the following statement(s) is/are correct?

A. The stability constant of $\left[Co\left(H_2O\right)_6\right]^{3+}$ is larger than that of $\left[Co\left(H_2O\right)_6\right]^{2+}$

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

C. The stability of halide complexes follows the order $I^{\Theta} > Br^{\Theta} > CI^{\Theta} > F^{\Theta}$.

D. The stability constant of $\left[Co\left(NH_3\right)_4\right]^{2+}$ is less than that of $\left[CuCI_4\right]^{2-}$.

Answer: A::B

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Exercises Single Correct (Naming And Terminology)

1. Select the correct $IUPAC$ name for

$\left[Ti\left(\pi\text{ - }C_5H_5\right)_2\left(O\text{ - }C_5H_5\right)_2\right]$.

A. $\left(\eta^5\right.$-cyclopentadine) bis (cyvclopentadierthyl) titanate(IV) .

B. $\left(\eta^5\right.$-cyclopentadine) bis (cyvclopentadierthyl) titanate(IV) .

C. (cyclopentadine) bis (beta^(5)-cyvclopentadierthyl) titanate(IV) .

D. $\left(\eta^5\text{ - }cyclopentad \in e\right)$ bis (cyvclopentadierthyl) titanate(IV) .

Answer: B

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2. Select the correct $IUPA$ name of

$\left[Mo\left(\sigma\text{ - }C_3H_5\right)\left(\pi\text{ - }C_5H_5\right)\left(CO_3\right)\right]$.

A. Tricarbonyl $\left(\eta^5\right.$-cyclopentadinenyl) ally1 molybdate(II) .

B. Allytricarbonyl$\left(\eta^5\right.$-cyclopentadiene)molybdate(II)

C. Allytricarbonyl$\left(\eta^5\right.$-cyclopentadiene)molybdate(II)

D. Allytricarbonyl$\left(\eta^5\right.$-cyclopentadiene)molybdate(II)

Answer: D

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3. $IUPA$ name for $\left[Fe(CO)_2\left(\sigma - C_5H_5\right)\left(\pi - C_5H_5\right)\right]$ complex :

A. Dicarbony1 (η^5-cyclopentadieny1)(cyclopentadieny1) ferrate(II)

B. Dicarbony1 (η^5-cyclopentadieny1)(cyclopentadieny1) iron(II)

C. Dicarbony1 (η^5-cyclopentadieny1)(cyclopentadieny1) iron(II)

D. Dicarbony1 (η^5-cyclopentadieny1)(cyclopentadieny1) iron(II)

Answer: A

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4. Select the correct $IUPA$ name for $\left[Cr\left(C_6H_6\right)(CO)_3\right]$.

A. $\left(\eta^6\right.$benzene) tricarbonylchromate(0)

B. Tricarbony1$\left(\eta^6\right.$benzene) tricarbonylchromate(0)

C. Tricarbony1$\left(\eta^6\right.$benzene) tricarbonylchromate(0)

D. $\left(\eta^6\right.$benzene) tricarbonylchromate(0)

Answer: D

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5. $IUPAC$ name for complex $\left[Mn\left(\pi - C_6H_5\right)(CO)_3\right]$:

A. Tricarbonyl $\left(\eta^5\right.$-cyclopentadiene)manganes(I)

B. Tricarbonyl $\left(\eta^5\right.$-cyclopentadiene)manganes(I)

C. Tricarbonyl $\left(\eta^5\right.$-cyclopentadiene)manganes(I)

D. $\left(\eta^5\right.$-cyclopentadiene)manganes(I)

Answer: C

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6. Ligand with two or more points of attachment to single metal atoms are called .

A. Monodentate ligand

B. Chelating ligand

C. Ambidentate ligand

D. None of these

Answer: B

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7. The number of ions produced by the complex $\left[Cr\left(NH_3\right)_4CI_2\right]CIO_3$ is .

A. 2

B. 3

C. 4

D. 6

Answer: A

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8. Which of the following is a tridentate ligand?

A. NO_2^{Θ}

B. Oxalate ion

C. Glycinate ion

D. Dien

Answer: D

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9. Coordination number of calcium is six in .

A. $[Mg(EDTA)]^{2-}$

B. MgC_2O_4

C. $Mg\left[\left(C_2O_4\right)_2\right]^{2-}$

D. $MgSO_4.4H_2O$

Answer: A

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10. Coordination number of Cu^{2+} in $CuSO_4.5H_2O$ is .

A. 5

B. 4

C. 3

D. 2

Answer: B

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11. The colsed ring compounds formed by bidentate ligands on binding to a metal or metal ions are called .

A. MoNodentate

B. Chelates

C. Ambidentate

D. None of these

Answer: B

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12. Which is the pair of ambidentate ligand?

A. CN^{-}, NO_2^{-}

B. NO_3^{-}, SCN^{-}

C. N_3^{-}, NO_2^{-}

D. $NCS^{-}, C_2O_4^{2-}$

Answer: A

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13. Number of water molecules acting as ligands in

$CuSO_4.5H_2O, ZnSO_4.5H_2O, FeSO_4.7H_2O$ respectively are .

A. $5, 5, 7$

B. $4, 5, 4$

C. $4, 4, 6$

D. $4, 4, 7$

Answer: C

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14. Select the correct $IUPA$ name for

$\left[Pt\left(C_5H_5N\right)_4\left[\left[PtCI_4\right]\right.\right.$ complex

A. Tetrapyridineplatinate(II)tetrachloridoplatinate(II)

B. Tetrapyridineplatinate(II)tetrachloridoplatinate(II)

C. Tetrapyridineplatinate(II)tetrachloridoplatinate(II)

D. Tetrapyridineplatinum(II)tetrachloridoplatinate(II)

Answer: D

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15. Select the correct $IUPAC$ name of $\left[C_4H_4Fe(CO)_3\right]$ complex .

A. η^4-cyclebutadiene tricarbonyliron(0)

B. Tricarbonyl $\left(\eta^4\right.$-cyclobutadienyl)iron(0)

C. Tricarbonyl $\left(\eta^4\right.$-cyclobutadienyl)iron(1)

D. Tricarbonyl $\left(\eta^4\right.$-cyclobutadienyl)iron(0)

Answer: D

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16. Oxidation state of "V" in $Rb_4K\left[HV_{10}O_{28}\right]$ is .

A. $+5$

B. $+6$

C. $+\frac{7}{5}$

D. $+4$

Answer: A

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17. Coordination number of Cr is six A complex with $C_2O_4^{2-}$ en and superoxide O_2will be in the ration to make complex $\left[Cr\left(C_2O_4\right)_{x'}(en)_y\left(O_2-(z)\right]^{\Theta}\right.$.

A. $\begin{matrix} x & y & z \\ 1 & 1 & 1 \end{matrix}$

B. $\begin{matrix} x & y & z \\ 1 & 1 & 2 \end{matrix}$

C. $\begin{matrix} x & y & z \\ 1 & 2 & 2 \end{matrix}$

D. $\begin{matrix} x & y & z \\ 2 & 1 & 1 \end{matrix}$

Answer: D

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18. The compound $\left[CoCI_3I\left(C_5H_5N\right)_2\right]$ Br will show the chemical test for which of the following ions? .

A. Br^{Θ}

B. CI^{Θ}

C. I^{Θ}

D. Br^{Θ} as well as CI^{Θ}

Answer: A

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19. The correct *IUPAC* name of $[Mn_3(CO)_{12}]$ is .

A. Dodecacarbonylmanganate(0)

B. Dodecacarbonylmanganate(*II*)

C. Dodecacarbonylmanganate(0)

D. Manganiododecarbonyl(0)

Answer: C

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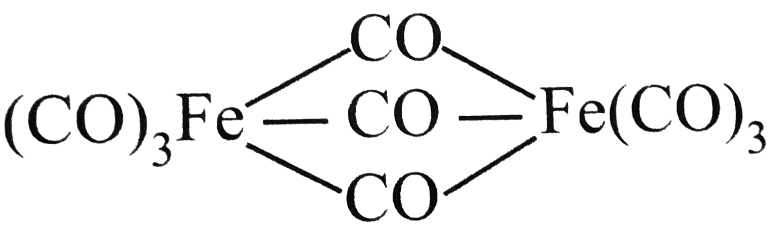
20. The correct name of



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A. Tri-mu-carbonylbis(tricarbonyl)iron(0))

B. Hexacarbonyliron(III)mu-tricarbonylferrate(0)

C. Tricarbonyliron(0)mu-tricarbonyliron(0)

D. Nonacarbonyl iron

Answer: A

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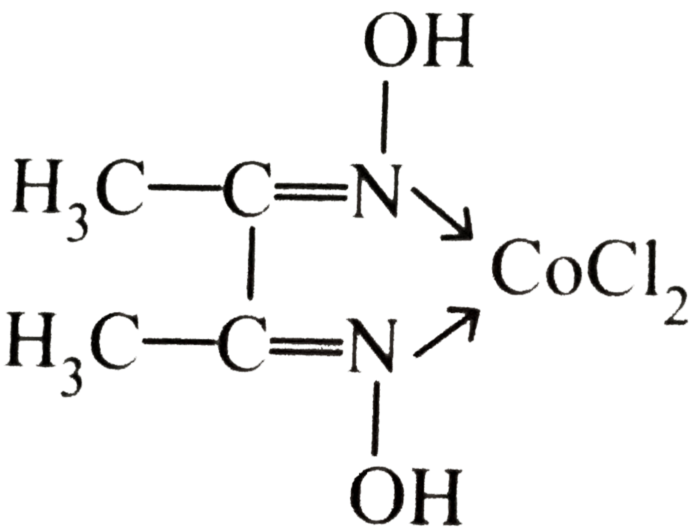
21. The correct *IUPAC* name of the complex



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A. Dichloridodimethylglyoximatocobalt(II)

B. Bis(dimethylglyoxime) dichlorocobalt(II)

C. Dimethylglyoximecobalt(II)chloride

D. Dichloridodimethylglyomine-N,N-cobalt(II)

Answer: A

Watch Video Solution

22. The correct $IUPA$ name of $\left[AICI_3\right].4(EtOH)$ is .

A. Aluminium(II) chloride-4-ethanol

B. Trichloridoaluminium(III)-4-ethaol

C. Aluminium(III)chloride-4-hydroxyethane

D. Aluminium chloride-4-ethanol

Answer: B

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23. In octaamine -μ-dihydroxodiiron(III)sulphate the number of bridging ligands is

A. 2

B. 1

C. 3

D. None

Answer: A

Watch Video Solution

24. The $IUPA$ name of the complex having formula $\left.[CO)_3Fe(CO)_3Fe(CO)_3\right]$ is .

A. Monocarbonylferrate(0)

B. Tricarbonyliron(0) - μ-tricarbonyliron(0)

C. Tri-μ carbonylbis-{tricarbonyliron(0)}

D. Hexacarbony1 `-mu- tricarbonyliron(III)

Answer: C

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25. A group of atoms can funcation as a ligand only when .

A. a.It is a small molecule

B. b.It is capable of acting as donor of electron pair

C. c.it is a negatively charged ion

D. d.It is a positively charged ion .

Answer: B

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26. Which of the following is most likely structure of $CrCl_3.6H_2O$ if $1/3$ of total chlorine of the compound is precipitated by adding $AgNO_3$ to its aqueous solution?

A. $CrCl_3.6H_2O$

B. $\left[Cr\left(H_2O\right)_3Cl_3\right]\left(H_2O\right)_3$

C. $\left[CrCl_2\left(H_2O\right)_4\right]Cl.2H_2O$

D. $\left[CrCl.\left(H_2O\right)_5\right]Cl_2.H_2O$

Answer: C

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27. The coordination number of a central ion may be obtained from

A. a.The number of only anionic bonds formed with the surrounding ions

B. b.The number of coordinate bonds formed with the surrounding atoms

C. c.The number of ions of opposite charge immediately surrounding the specific ion .

D. d.None of the above

Answer: D

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28. Which of the following is nonionisable?

A. $\left[Co\left(NH_3\right)_3CI_3\right]$

B. $\left[Co\left(NH_3\right)_4CI_2\right]CI$

C. $\left[Co\left(Nh_3\right)_5CI\right]CI_2$

D. $\left[Co\left(NH_3\right)_6\right]CI_3$

Answer: A

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29. Which of the following pair contains complex salt and double salt respectively?

A. $FeSO_4, K_4\left[Fe(CN)_6\right]$

B. $\left[Cu\left(NH_3\right)_4\right]SO_4, FeSO_4.7H_2O$

C. $\left[Cu\left(NH_3\right)_4\right]SO_4, K_2SO_4Al_2\left(SO_4\right)_3.24H_2O$

D. $MgSO_4.7H_2O, CuSO_4.5H_2O$

Answer: C

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30. In Which of the following compunds the metal is in the lowest oxidation state?

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

B. $Fe_3\left[Fe(CN)_6\right]_2$

C. $\left[Mn_2(CO)_{10}\right]$

D. $K\left[PtCI_3\left(C_2H_4\right)\right]$

Answer: C

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31. Which of the following can be termed as mixed complex? .

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

B. b. $\left[Cu\left(NH_3\right)_4\right]SO_4$

C. c. $\left[Co\left(NH_3\right)_4NO_2CI\right]CI$

D. d. K_2FeSO_4

Answer: C

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Exercises Single Correct (Isomerism)

1. Among the following select the order of decreasing EAN valuse

$\left[cr(CO)_6\right]$

(II) $\left[Cr(CO)_6\right]^{\Theta}$

(III) $\left[Cr(CO)_6\right]^{\oplus}$

A. $I > II > III$

B. $III > II > I$

C. $II > I > III$

D. $II = I > III$

Answer: C

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2. Increasing order EAN of the metals in

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

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

(III) $\left[Cu(CN)_4\right]^{3-}$ is .

A. $I < II < III$

B. $I < II = III$

C. $I < III < II$

D. $III < II < I$

Answer: A

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3. EAN of na$\left[PtCI_3\left(\eta^2 - C_2H_2\right)\right]$ is .

A. 86

B. 78

C. 84

D. 34

Answer: C

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4. $EAN$of$\left[Fe\eta^2 - C_5H_5\right)(CO)_2CI\right]$:

A. 36

B. 35

C. 37

D. 34

Answer: A

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5. Which has maximum EAN of the underbold atoms?

$(Cr = 24, Co = 27, Fe = 26, Ni = 28)$.

A. a.$[Cr(EDTA)]^{\Theta}$

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

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

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

Answer: B

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6. Give EAN value of Mg in $[Mg(EDTA)]^{2-}$.

A. 16

B. 20

C. 22

D. 18

Answer: C

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7. EAN of cobalt is 36 in $\left[Co\left(NH_3\right)_2O_2(en)br\right]$ Thus O_2 is .

A. dioxide

B. superoxide ion

C. peroxide ion

D. oxide

Answer: C

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8. EAN of Fe in $\left[Fe\left(C_2O_4 - (3)\right]^{3-}$ is .

A. 27

B. 24

C. 35

D. 29

Answer: C

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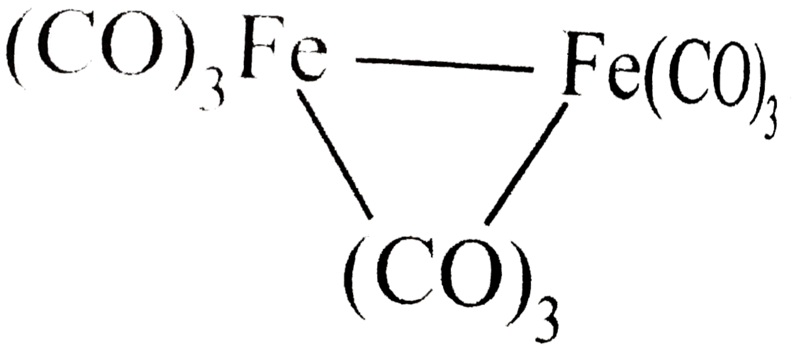
9. The EAN of Fe atom in `



A. 34

B. 35

C. 36

D. 37

Answer: C

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10. $\left[Co\left(NH_3\right)_6\right]\left[Cr(CN)_6\right]$ and $\left[Cr\left(NH_3\right)_6\right]\left[Co(CN)_6\right]$ are .

A. Linkage isomers

B. Ionisation isomers

C. Coordination isomers

D. None of these

Answer: C

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11. The Type of isomerism present in pentaammine nitro chromium(III) perchlorate is .

A. Optical

B. Linkage

C. Hydrate

D. Polymerisation

Answer: B

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12. Which of the following has the largest number of isomers? .

A. a. $\left[Cr(en)_2Cl_2\right]^{\oplus}$

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

C. c. $\left[Ru\left(NH_3\right)_4Cl_2\right]^{\oplus}$

D. d. $\left[Ir\left(PR_3\right)_2(CO)_2\right]^{2+}$

Answer: A

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13. $\left[Cr\left(NH_3\right)_5NO_2\right]SO_4$ and $\left[Cr\left(NH_3\right)_5ONO\right]SO_4$ are related to each other as: .

A. Geometrical isomers

B. Linkage ismomers

C. Coordination isomers

D. Ionisation ismers

Answer: B

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14. Which one of the following will be able to show geometrical isomerism if complexes are square planar? .

A. Ma_4

B. Ma_3b

C. $Mabcd$

D. $\left[M(AA)_2\right]$

Answer: C

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15. The number of geometrical and optical isomers of

$\left[Cr\left(NH_3\right)_3\left(NO_3\right)_3\right]$ is .

A. 3

B. 2

C. 0

D. 4

Answer: B

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16. Both geometrical and optical isomerisms are not shown by

A. a. $\left[Co(en)_2Cl_2\right]^{\oplus}$

B. b. $\left[Co\left(NH_3\right)_2Cl_4\right]^{-}$

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

D. d. $\left[Co\left(NH_3\right)_4Cl_2\right]^{\oplus}$

Answer: A

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17. In $\left[Co\left(C_2O_4\right)_3\right]^{3-}$, the isomerism shown is .

A. Ligand

B. Optical

C. Geometrical

D. Ionisation

Answer: B

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18. Which of the following octahedral complex does not show geometrical isomerism (A and B are monodentate ligands) ?

A. a.$[MA_3B_3]$

B. b.$[MA_4B_2]$

C. c.$[MA_5B]$

D. d.$[MA_2B_4]$

Answer: C

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19. Facial-meridional isomers is associated with which one of the following complex (M = central metal) .

A. $\left[M(AA)_2\right]$

B. $\left[MA_3B_3\right]$

C. $[MABCD]$

D. $\left[M(AA)_3\right]$

Answer: B

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20. The total number of possibel coordination isomer for the given compounds $\left[Pt\left(NH_3\right)(4)Br_2\right]\left[PtBr_4\right]$ is .

A. 2

B. 4

C. 5

D. 3

Answer: B

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21. The following complexs are given?

trans-$\left[Co\left(NH_3\right)_4 1_2\right]^{\oplus}$

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

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

[Ni1_(4)]^(2-)[Tif_(6)]^(2-)[CoF_(6)]^(3-)`

Choose the correct code .

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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22. The following represents a pair of enantiomers:

A. a.trans-$\left[CrCl_2(en)_2\right]^{\oplus}$

B. b.cis - $\left[CrCl_2(en)_2\right]^{\oplus}$

C. c.trans-$\left[CrCl_2\left(NH_3\right)_4\right]^{\oplus}$

D. d.cis - $\left[CrCl_2\left(NH_3\right)_4\right]^{\oplus}$

Answer: B

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23. The compounds $\left[PtBr_2\left(NH_3\right)_2\right]$ can form .

A. Geometrical isomers

B. Coordination isomers

C. Optical isomers

D. Linkage isomers

Answer: A

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24. The compound $\left[CrCl_2\left(NH_3\right)_2(en)\right]$ can form .

A. Geometrical isomers

B. Coordination isomers

C. Optical isomers

D. Linkage isomers

Answer: C

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25. One mole of complex compound $Cr(NH_3)_5CI_3$ gives 3 moles of ions on

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

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

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

D. d. $\left[Cr(NH_3)Cl_3.2NH_3\right.$

Answer: C

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26. Which of the following will show optical isomerism? .

A. $\left[ZnCl_4\right]^{2-}$

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

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

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

Answer: C

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27. In which of the following pairs both the complex show optical isomerism? .

A. a)cis - $\left[Cr\left(C_2O_4\right)_2CI_2\right]^{3-}$, cis - $\left[Co\left(NH_3\right)_4CI_2\right]$

B. b) $\left[Co(en)_3\right]CI_3$, cis - $\left[Co(en)_2CI_2\right]CI$

C. c) $\left[Co\left(NO_3\right)_3\left(NH_3\right)_3\right]$, cis - $\left[Pt(en)_2CI_2\right]$

D. d) $[PtCI(en)CI]$, $\left[NiCI_2Br_2\right]^{2-}$

Answer: B

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28. Which of the following gives the maxium number of isomers?

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

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

C. $\left[Ni\left(C_2O_4\right)(en)_2\right]$

D. $\left[Cr(SCN)_2\left(NH_3\right)_4\right]^{\oplus}$

Answer: D

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29. The possible number of the optical isomers in $\left[Cr(en)_2CI_2\right]^{\oplus}$ is .

A. 6

B. 3

C. 4

D. 2

Answer: B

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30. Which of the following molecules$(s)is/are$ not showing optical isomerism ? .

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

B. $\left[Co\left(NH_3\right)_3Br_3\right]$

C. $\left[Co(en)_2Br_2\right]Br$

D. $\left[Co(en)\left(NH_3\right)_2Br_2\right]Br$

Answer: B

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

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

B. b) $\left[Co(en)_2CI_2\right]CI$

C. c) $\left[Pt\left(NH_3\right)_4\right]\left[PtCI_6\right]$

D. d) $\left[Co\left(NH_3\right)_4CI_2\right]NO_2$

Answer: B

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32. Both Cr^{3+} and Pt^{4+} have a coordination number of 6 Which of the following pairs of complexes will show approximately the same electrical conductance for their $0.1M$ aqueous solutions ?

A. a)$CrCI_3.4NH_3$ and $PtCI_4.4NH_3$

B. b)$CrCI_3.3NH_3$ and $PtCI_4.5NH_3$

C. c)$CrCI_3.6NH_3$ and $PtCI_4.5NH_3$

D. d)$CrCI_3.5NH_3$ and $PtCI_4.5NH_3$

Answer: C

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33. Select the correct statement for $\left[M(AB)b_2cd\right]$.

A. a.All geometrical isomers are optically active .

B. b.It has four trans isomer with respect to b

C. c.It has seven geometrical isomers .

D. d.It has three cis and two trans isomers with respect to b .

Answer: C

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Exercises Single Correct (Hybridisation , Magnetic And Optical Properties)

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

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

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

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

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

Answer: B

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2. Which of the folliwng is paramagnetic ? .

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

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

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

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

Answer: D

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3. The pair in which both species have same magnetic moment (spin only value) is .

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

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

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

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

Answer: B

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4. Select the correct order of magnetic moment (inBM) from the folliwng options

(I) $\left[MnCI_4\right]^{2-}$ (II) $\left[CoCI_4\right]^{2-}$

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

A. $I > II > III$

B. $III > II > I$

C. $III > I > II$

D. $I > III > II$

Answer: A

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5. Which of the pair of complex compounds are tettrahedral as well as diamagnetic ? .

A. a.$\left[CoCl_4\right]^{\Theta}$ and $\left[Co(CO)_4\right]^{\Theta}$

B. b.$\left[Ag(SCN)_4\right]^{2-}$ and $\left[NiCl_4\right]^{2-}$

C. c.$\left[Co(CO)_4\right]^{\Theta}$ and $\left[Ni(CN)_4\right]^{4-}$

D. d.$\left[PdCl_4\right]^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$

Answer: C

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6. Which of the following has a square planar geometry? .

A. $\left[PtCl_4\right]^{2-}$

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

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

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

Answer: A

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7. Among $\left[Ni(CO)_4\right]$, $\left[Ni(CN)_4\right]^{2-}$ and $\left[NiBr_4\right]^{2-}$ species, the hybridisation state of Ni atoms are respectively .

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

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

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

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

Answer: B

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8. Coordination compounds plays many important roles in animals and plants. The are essential in the storage and transport of oxygen as electrons transfer agents as catalysts and in photosynthesis Wide range of application in daily life takes place through formation of complexes Photographic fixing qualitative and quantitative analysis purification of water metallurgical extraction are some specific worth mentioning

Arrange of the following in order of decreasing number of unpaired electrons

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

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

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

(IV) $\left[fe\left(H_2O\right)_6\right]^{3+}$

(a) IV,I,II,III

(b) I, II, III, IV

(c) III, II, IIV

(d) II,III,I,IV` .

A. IV, I, II, III

B. I, II, III, IV

C. III, II, I, IV

D. II, III, I, IV

Answer: A

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9. A substance which is not paramagnetic is .

A. $Cr(ClO_4)_3$

B. $KMnO_4$

C. $TiCl_3$

D. $VOBr_2$

Answer: B

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10. Which of the following statements is correct ?

A. $[Ni(CN)_4]^{2-}$ complex is more stable than $[Ni(dmg)_2]$ due to higher $CFSE$ value .

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

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

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

Answer: C

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11. An aqueous solution of titanium bromide shows zero magnetic moment. Assuming the complex as octahedral in aqueous solution the formula of the complex is .

A. $\left[TiBr_6\right]^{3-}$

B. $\left[Ti\left(H_2O\right)_6 Br_4\right.$

C. $\left[TiBr_6\right]^{2-}$

D. $Ti\left(H_2O\right)_4 Br_2\right]$

Answer: B

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12. Geometry, hybridisation and magnetic moment of the ions $\left[Ni(CN)_4\right]^{2-}$, $\left[MnBr_4\right]^{2-}$ and $\left[FeF_6\right]^{3-}$ respectively are .

A. Tetrahedral square planar,octahedral $dsp^2, sp^3, sp^3 : 0, 5.9, 4.9$.

B. Tetrahedral square planar,octahedral $sp^3, dsp^2, sp^3d^2 : 5.9, 0, 4, 9$.

C. Square planar,tetrahedral,octahedral:

$dsp^2, sp^3, d^2sp^3 : 5.9, 4.9, 0$.

D. Tetrahedral square planar,octahedral $dsp^2, sp^3, sp^3d^2 : 0, 5, 4.9$.

Answer: D

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13. The correct order of magnetic moment (spin values in is .

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

(I) $\left[MnBr_4\right]^{2-}$(II)$\left[Fe(CN)_6\right]^{4-}$ (III) $\left[CoBr_4\right]^{2-}$.

A. $II > III > I$

B. $I > II > III$

C. $II > I > III$

D. $I > III > II$

Answer: D

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14. A square planar complex is formed by hybridisation of which atomic oritals?

A. s, p_x, p_y, d_{yz}

B. s, p_x, p_y, d_{x2-y2}

C. s, p_y, p_z, d_{xy}

D. s, p_x, p_y, d_{x2}

Answer: B

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15. The colour of a complex compound is due to .

A. Promotion of 3d-electrons of the central atom//ion to 4p-orbitals.

B. Promation of 3d-electrons of the central atom//ion to 4s-orbitals

C. Promation of 3d-electrons of the central atom//ion within d-orbitals

D. Promation of 3d-electrons of the central atom//ion to 4s-orbitals

Answer: C

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16. If a transition-metla compound absorbs violet-indigo radiation in the visible region Its colour would be .

A. Green

B. Yellow

C. Orange

D. Blue

Answer: B

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17. Transition metal compounds are usually coloured This is due to the electronic transition .

A. From d-orbital to s-orbital

B. From p-orbital to s-orbital

C. From d-orbital to s-orbital

D. Within the d-orbital

Answer: D

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18. Which of the following compound is not coloured ?

A. $Na_2[CuCl_4]$

B. $Na_2[CdCl_4]$

C. $K_4[Fe(CN)_6]$

D. $K_3[Fe(CN)_6]$

Answer: B

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19. The colour of $Cu^{\oplus}$ compounds is .

A. White

B. Blue

C. Orange

D. Yellow

Answer: A

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Exercises Single Correct (Crystal Field Theory (Cft))

1. Which of the following complex has higher $De < A_0$ VALUE?

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

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

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

D. All have equal

Answer: C

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2. Relative to the average enerage in the spherical crystal field the t_{2g} orbitals in tetrahedral field is .

A. Reised $(2/5)\Delta_t$

B. Lowered by $(2/5)\Delta_t$

C. Reised $(3/5)\Delta_t$

D. Lowered by $(1/5)\Delta_t$

Answer: A

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3. The crystal field splitting energy for octahedral$\left(\Delta_0\right)$ and tetrahedral $\left(\Delta_t\right)$ complexes is related as .

A. $\Delta_t = \frac{4}{9}\Delta_0$

B. $\Delta_t = \frac{1}{2}\Delta_0$

C. $\Delta_0 = - 2\Delta_t$

D. $\Delta_0 = - \frac{4}{9}\Delta_t$

Answer: A

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

A. $3d^1_{xy}, 3d^1_{yz}, 3d^1_{zx}$

B. $3d_{xy}^1, 3d_{yz}^1, 3d_{z2}^1$

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

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

Answer: A

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5. In which of the following cordination entities, the magnitude of $\Delta_0[CFSE$ in octahedral field] will be maximum ?

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

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

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

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

Answer: A

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6. In which of the following configuration will there be the possibillity of both para and diamagnetism depending on the nature of the ligands ?

A. d^3

B. d^7

C. d^6

D. d^5

Answer: C

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7. For Mn^{3+} ion the electron pairing energy P is about $28,000cm^{1-}$, Δ_0 values for the complexes $\left[Mn\left(H_2O\right)_6\right]^{3+}$ and $\left[Mn(CN)_6\right]^{3-}$ are $15,800cm^{-1}$ and $38,500cm^{-1}$ respectively which of the following complex is high spin .

A. Both are high spin

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

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

D. Noen of these

Answer: B

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8. Which of the following ligands are correctly represented in an spectrochemical series ? .

A. a.$SCN^{\ominus}, F^{\ominus}, CN^{\ominus}$

B. b.$SCN^{\ominus}, CN^{\ominus}, F^{\ominus}$

C. c.$F^{\ominus}, SCN^{\ominus}, CN^{\ominus}$

D. d.$F^{\ominus}, CN^{\ominus}, SCN^{\ominus}$

Answer: A

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9. The increasing of the crystal field splitting power of some common ligands is ? .

A. $NH_3 < NO_2^{\ominus} < CN^{\ominus} < H_2O$

B. $H_2O < NO_2^{\ominus} < CN^{\ominus} < NH_3$

C. $H_2O < NH_3 < NO_2^{\ominus} < CN^{\ominus}$

D. $H_2O < NH_3 < CN^{\ominus} < NO_2^{\ominus}$

Answer: C

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10. Velence bond theroy describes the bonding in complexs in terms of coordinate -covalent bond resulting from overlap filled ligand orbitals with vacant metal hybrid orbitals This theory explains magnetic behaviour and geometrical shape of coordination compounds Magnetic moment of a complex compound can be determined experimentally and theoretically by using spin only formula

Magnetic moment $\sqrt{n}(n+2)BM$ (where n = No. unpaired electrons) .

The value of of spin only magnetic moment for octahedral complex of the following configuration is $2.84BM$ The correct statement is

(a) d^4 (in weak field ligand)

(b) d^2 (in weak field and in strong field ligand)

(c) d^3 (in weak field and in strong field ligand)

(d) d^5 (in strong field ligand) .

A. d^4(in strong field ligand)

B. d^2(in strong field ligand)

C. d^3(in weak as well as in strong field ligand)

D. d^5(in strong field ligand)

Answer: B

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11. The complex which has no d-electron in the central metal atom is .

A. $[MnO_4]^{\Theta}$

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

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

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

Answer: A

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12. Which of the following statement is correct for the complex $Ca_2\left[Fe(CN)_5O_2\right]$ having t_{2g}^6, e_g^0 electronic configuration ? .

A. d^2sp^3 hybridised and diamagnetic

B. sp^3d^2 hybridised and paramagnetic

C. sp^3d^2 hybridised and diamagnetic

D. d^2sp^3 hybridised and paramagnetic

Answer: D

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13. Which of the folliwing complex is inner orbital as well as low spin complex? .

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

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

C. $\left[Cu(CN)_4\right]^{3-}$

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

Answer: B

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14. The magnetic moment of a complex (A) of Co was found to be $4.89BM$ and the $EANas36$ co alos forms complex (B) with magnetic moment $3.47BM$ and EAN as37 and complex (C) with EAN as $36but$ diamagnetic Which of the following statements is true regarding the above observation?

A. The oxidation states of Co in (A),(B) and (C) are $+3, +2$ and $+3$ respectively .

B. Complexes (A) and (B) have sp^3d^2 hybridisation state while (C) has dsp^3 hybrisation state .

C. The spin multiplicities of Co in $(A), (B)$ and (C) are 3,2 and 1,respectively .

D. The oxidation states of Co in $(A), (B)$ and (C) are $+6, +8$ and $+1$ respectively .

Answer: A

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15. Spin only magnetic moments of a d^8 ion in octahedral square planar and tetrahedral complexes, respectively are .

A. $2.8 BM$, 0 and $2.8 BM$

B. 0, 0 and BM

C. 2.8, 2.8 and BM

D. None of these

Answer: A

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Exercises Single Correct (Application Of Coordination Compounds And Miscellaneous)

1. Which of the following is incorrect about Wilkinson s catalyst ? .

A. a)It is a diamagnetic complex

B. b)It is a non-ionic complex

C. c)It is a tetrahedral complex

D. d)It is very effective for selective hydrogenation of organic molecule at room temperature and pressure .

Answer: C

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2. Which bond properties are consistent with one another?

A. $\begin{array}{ccc} Bond\text{order} & Bond\text{length} & Vibrational\text{equency} \\ higher & \text{shorter} & higher \end{array}$

B. $\begin{array}{ccc} Bond\text{order} & Bond\text{length} & Vibrational\text{equency} \\ lower & \text{shorter} & lower \end{array}$

C. $\begin{array}{ccc} Bond\text{order} & Bond\text{length} & Vibrational\text{equency} \\ higher & \text{longer} & lower \end{array}$

D. $\begin{array}{ccc} Bond\text{order} & Bond\text{length} & Vibrational\text{equency} \\ lower & \text{longer} & higher \end{array}$

Answer: A

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3. Select the correct order of C - O bond order in mixed phosphine carbony1 complex

(I) $\left[Mo\left(Ph_3P\right)_3(CO)_3\right]$ (II) $\left[Mn\left(Ph_2PCI_3\right)(CO)_3\right]$ (III) $\left[Mo\left(PhCI_2\right)_3(CO)_3\right]$.

A. IgtIIgtIII

B. 'IgtIIgtIII'

C. I=IIgtIII

D. IltIIgtIII

Answer: B

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4. Compare C - C bond length (x) of C_2H_4 in Zeise ' s salt and C - C bond length (y) of $C_2(CN)_4$ in $K\left[PtCI_3C_2(CN)_4\right]$.

A. $x > y$

B. $y > x$

C. $x = y$

D. None of these

Answer: B

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5. Which of the following organometallic compound is a sigma and pi bonded? .

A. $\left[Fe\left(\eta^{5}\text{-}C_{5}H_{5}\right)_{2}\right]$

B. $K\left[PtCI_{3}\left(\eta^{2}\text{-}C_{2}H_{4}\right)\right]$

C. $\left[Co(CO)_{5}NH_{3}\right]^{2+}$

D. $\left[Fe\left(CN_{3}\right)_{3}\right]$

Answer: C

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6. Which of the following statement(s) is//are true or false?

S_1 Complexes having d^0 or d^{10} configuration of metal ions are always diamagnetic

S_2 In organometallic compounds, carbon is bonded to metals directly

S_3 In $Fe(CO)_5$ the Fe - C bond possesses both σ and π characteristics

S_4 Extra stability of metal carbonyls is explained by synergic bonding

.

A. $TTTT$

B. $FTFT$

C. $TTFF$

D. $FTTT$

Answer: A

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7. Which of the following complex can act as an oxidising agent as well as reducing agent?

A. $Mn(CO)_5$

B. $Ti(CO)_6$

C. $Mn(CO)_6$

D. None of these

Answer: D

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8. Which of the following statements is correct for the $\left[Fe\left(H_2O\right)_5NO\right]SO_4$ complex ? .

A. The EAN value of Fe in this complex depends on the charge of NO ligand .

B. The EAN value of Fe in this complex depends on the charge of NO ligand .

C. The hybridisation of the central atom is d^2sp^3 .

D. It is paramagnetic with $\mu = 1.73BM$.

Answer: B

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9. Which of the following is not considered as an organometallic compounds ? .

A. Ferrocene

B. Cis-platin

C. Zeise's salt

D. Grignard reagent

Answer: B

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10. Among the following which is not the pi-bonded organpmetallic compound? .

A. $(CH_3)_4Pb$

B. $\left[Cr\left(\eta^6 - C_6H_6\right)_2\right]$

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

D. $K\left[PtCI_3\left(\eta^2 - C_2H_4\right)\right]$

Answer: A

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11. Magnesium is an important component of which biomolecule occuring extensively in living world?

A. Haeomoglobin

B. Chlorophy11

C. Florigen

D. ATP

Answer: B

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12. Among the properties (A) reducing(B) oxidising (C) complexing the set of properties shown by CN^{Θ} ion towards metal species is .

A. Tetrahedral $d_{x^2-y^2}$

B. Tetrahedral bipyramidal $d_{x^2-y^2}$

C. Tetrahedral bipyramidal d_{z2}

D. Asquare pyramidal

Answer: C

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13. Among the properties (A) reducing(B) oxidising (C) complexing the set of properties shown by CN^{Θ} ion towards metal species is .

A. B, C

B. A, B, C

C. C, A

D. A, B

Answer: C

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14. Ferrocene is

A. $\left[Fe\left(\eta^2 - C_6H_5\right)_2\right]$

B. $\left[Fe\left(\eta^5 - C_5H_5\right)_2\right]$

C. $\left[Fe\left(\eta^6 - C_6H_5\right)_2\right]$

D. $\left[Fe\left(\eta^3 - C_3H_3\right)_2\right]$

Answer: B

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15. Dimethylglyoxime is coordinated to Ni^{2+} through .

A. Two oxgen atoms

B. Two nitrogen atoms

C. Two oxygen and one nitrogen atoms

D. Two oxygen and one nitrogen atoms

Answer: B

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16. in isolated condition C - C bond length of C_2H_4 is x than the bond length ofn C - C bond of C_2H_4 in Zeise 's salt is .

A. Greater thanx

B. Less than x

C. Equal to x

D. None of these

Answer: B

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17. When $K_4\left[Fe(CN)_6\right]$ is treated with $FeCI_3$ a blue colour is obtained It is due to the formation of .

A. $Fe^{II}\left[Fe^{III}(CN)_6\right]^{\Theta}$

B. $Fe^{III}\left[Fe^{II}(CN)_6\right]^{\Theta}$

C. Both (a) and (b)

D. None of these

Answer: C

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18. The common features among the species CN^{-}, CO and NO^{+} are :

A. bond order three ans isoelectronic

B. bond order three and weak field ligands

C. isoelectronic and weak field ligands

D. bond order two and pi acceptors.

Answer: A

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19. Consider the follwing complex:

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

The coordiantion number, oxidation number, number of d-electrons and number of unpaired d-electrons of the metal are respectively:

A. 6, 3, 6, 0

B. 7, 1, 6, 4

C. 7, 2, 7, 1

D. 6, 2, 7, 3

Answer: A

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20. The bond length of $C - O$ bond in carbon monoxide is $1.128A$ The $C - O$ bond in $\left[fe(CO)_5\right]$ is .

A. $1.115A$

B. $1.128A$

C. $1.178A$

D. $1.150A$

Answer: D

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21. The most stable ion is .

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

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

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

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

Answer: A

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22. The number of sigma and π-bonds in $Fe_2(CO)_9$` respectively are .

A. 22σ and 15π

B. 22σ and 16π

C. 23σ and 15π

D. 15σ and 8π

Answer: A

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23. $Ag^{\oplus}$ forms complexes some of these are

$\left[Ag\left(NH_3\right)_2\right]^{\oplus}, 2\left[Ag(CN)_2\right]^{\Theta}, \left[Ag\left(S_2O_3\right)_2\right]^{3-}$

Which of the following statements is true? .

A. In these complexes, $Ag^{\oplus}$ is a Lewis bese .

B. The hybrisation $Ag^{\oplus}$ is sp^2 .

C. The $Ag^{\oplus}$ complexes are good reducing agents.

D. These complexes are all linear .

Answer: D

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24. Hardness of water is estimated by simple complex formation titration Complex formed by cation in hard water during estimation of hardness is .

A. $Na_2\left[Ca\left(PO_3\right)_6\right]$

B. $Na_2[Mg(EDTA)]$

C. $\left[Ca\left(So_4\right)_2\right]^{2-}$

D. $Na[Pb(EDTA)]$

Answer: B

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25. The ligand called pi- acid is .

A. CO

B. $C_2O_2^{2-}$

C. NH_3

D. ethylene

Answer: A

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26. The complex used as an anticancer agent is

A. $mer - \left[co\left(NH_3\right)_3CI_3\right]$

B. $cis - \left[PtCI_2\left(NH_{3\,-\,(2)}\right]$

C. $Na_2\left[CoCI_4\right]$

D. $cis - K_2\left[Pt\left(CI_2Br_2\right]$

Answer: B

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27. Which is uses in cancer chemotherapy? .

A. cis-platin

B. Zeisse's salt

C. Both(a) and(b)

D. Noe of these

Answer: A

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28. Zeise' s salt is

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

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

C. $K\left[Pt\left(\eta^2 - C_2H_4\right)CI_3\right]$

D. $K\left[Pt\left(\eta^2 - C_2H_4\right)_2CI_2\right]$

Answer: C

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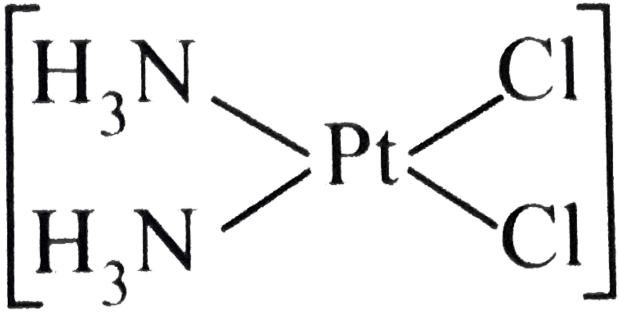
29. cis-diamminedichlorichloridoplatinum(II), $\left[Pt\left(NH_3\right)_2CI_2\right]$, is One of the number of platinum coordination compound is used in the treatment of cancer. Commonly known as cis-platin, this compound has the abillity to block the uncontrolled division of cancerous cells that results in the growth of tumours. Recent studies show that cisplatin can cause serious side effects including severe kidney damage. cis-platin is replaced by which of the following compounds



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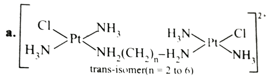
A. 

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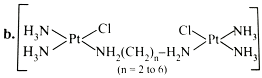
B. 

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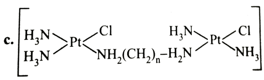
C. 

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D. None of the above is correct

Answer: A

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Exercises Assertion Reasoning

1. Assertion: All square planar complexes can exhibit geometrical isomerism

Reason: In square planar complexes .

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

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

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

D. Both (A) and (R) are incorrect .

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2. Assertion Metal carbonyls can be called organometallics

Reason Metal carbonyls do contain metal carbon bond .

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

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

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

D. Both (A) and (R) are incorrect .

Answer: D

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3. Assertion A sulphate ion is a biden tate ligand and can also act as monodentate in cartain complexes

Reason Many a times multidentate ligands do have flexidentate character .

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

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

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

D. Both (A) and (R) are incorrect .

Answer: A

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

Reason :Square planar complexes do not possess chiral structures.

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

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

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

D. Both (A) and (R) are incorrect .

Answer: A

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5. Assertion In aqueous solution Mohr' s salt gives $NH_4^{\oplus} Fe^{2+}$ and SO_4^{2-} ions

Reason Mohr' s salt is a double salt .

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

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

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

D. Both (A) and (R) are incorrect .

Answer: A

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6. Assertion Coordination compounds are generally formed by transition metals

Reason Transition metals generally have partly filled d-orbitals of the nth shell .

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

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

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

D. Both (A) and (R) are incorrect .

Answer: C

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7. Assertion Chelates are relatively more stable than non-cheltated complexes

Reason Complexes containing ligands which can be easily replaced by other ligands are called labile complexes .

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

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

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

D. Both (A) and (R) are incorrect .

Answer: B

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8. Assertion The complex $\left[Co\left(NH_3\right)_3CI_3\right]$ gives no precipitate with $AgNO_3$ solution

Reason The given complex is non-ionisable .

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

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

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

D. Both (A) and (R) are incorrect .

Answer: A

9. Ethylenediaminetraac etate ion froms an octo hedral complex with be metal ion

Reason It has six donor atoms which coordinate simultaneously to the metal 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 and (R) is the correct explanation of (A) .

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

D. Both (A) and (R) are incorrect .

Answer: A

10. Assertion The $\left[Ni(en)_3\right]CI_2$ (en = ethylenediamine has lower stability than $\left[Ni\left(NH_3\right)_6\right]CI_2$

Reason $In\left[Ni(en)_3\right]CI_2$ the geometry of Ni is 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 and (R) is the correct explanation of (A) .

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

D. Both (A) and (R) are incorrect .

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11. Assertion NF_3 is weaker ligands than $N\left(CH_3\right)_3$

Reason NF_3 ionises to give F^{Θ} ions in aqueous 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 and (R) is the correct explanation of (A) .

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

D. Both (A) and (R) are incorrect .

Answer: C

Watch Video Solution

12. Assertion The total number of isomers shown by $\left[Co(en)_2CI_2\right]^{\oplus}$ complex ion is three

$\left[Co(en)_2CI_2\right]^{2+}$ complex ion has an octahedral geometry .

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

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

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

D. Both (A) and (R) are incorrect .

Answer: B

Watch Video Solution

13. Assertion The ligands nitro and nitrito are called ambidenatate

Reason These ligands give likage isomers .

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

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

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

D. Both (A) and (R) are incorrect .

Answer: A

Watch Video Solution

14. Assertion Number of unpaired electrons present in $\left[Cu\left(NH_3\right)(2)\right]^{\oplus}$ complex is zero

Reason The complex is linear with sp-hybrisation .

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

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

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

D. Both (A) and (R) are incorrect .

Answer: B

Watch Video Solution

15. Assertion Glycinate ion is an example of monodentate ligand

Reason It contains N as the only donor 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 and (R) is the correct explanation of (A) .

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

D. Both (A) and (R) are incorrect .

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16. Assertion The number of unpaired electrons in $\left[Ni(CO)_4\right]$ is zero

Reason In this compounds 4s-electrons of Ni atom enter the inner d-orbitals to facilitate the sp^3 hybridisation in Ni 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 and (R) is the correct explanation of (A) .

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

D. Both (A) and (R) are incorrect .

Answer: A

Watch Video Solution

17. Assertion $Ni(CO)_4$ is tetrahedral in shape

Reason Ni atom is in zero oxidation state and undergoes sp^3 -

hybridisation in $Ni(CO)_4$.

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

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

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

D. Both (A) and (R) are incorrect .

Answer: A

Watch Video Solution

18. Assertion $\left[M(\forall)_3\right]^{n\pm}$ is optically inactive

Reason Plane of symmetry and center of symmetry are not present .

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

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

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

D. Both (A) and (R) are incorrect .

Answer: D

Watch Video Solution

19. Assertion The d_{C-O} in bridging carbonyl geroup is longer than that of terminal carbonyl group

Reason With increase in extent of synergic bonding the C - O bond length increases .

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

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

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

D. Both (A) and (R) are incorrect .

Answer: A

Watch Video Solution

20. Assertion A solution of $\left[Ni\left(H_2O\right)_6\right]^{2+}$ is green but a solution of $\left[Ni(CN)_4\right]^{2+}$ is colourless

Reason $\left[Ni(CN)_4\right]^{2+}$ is square planar complex .

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

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

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

D. Both (A) and (R) are incorrect .

Answer: B

Watch Video Solution

21. Δ_0 increases in the order of $\left[CrCI_6\right]^{3-} < \left[Cr(CN)_6\right]^{3-} < \left[Cr\left(C_2O_4\right)_3\right]^{3-}$ reason The stronger the ligand field the higher will be Δ_0 value .

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

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

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

D. Both (A) and (R) are incorrect .

Answer: D

Watch Video Solution

22. Assertion Hybridisation of $\left[AuCI_4\right]^{\Theta}$ is sp^3

Reason Hybridisation of Au in above complex compound does not depend upon the nature of 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 and (R) is the correct explanation of (A) .

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

D. Both (A) and (R) are incorrect .

Answer: D

Watch Video Solution

23. Assertion $NO^{\oplus}$ has a lower pi accepting tendency than the CO

Reason No donates 3 electrons into the vacant orbital of metal cation or 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 and (R) is the correct explanation of (A) .

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

D. Both (A) and (R) are incorrect .

Answer: D

Watch Video Solution

24. Assertion Complexes containing three bidentate ligands do not show optical activity

Reason Octahedral complex $\left[Co\left(NH_3\right)_4CI_2\right]CI$ shows geometrical isomerism .

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

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

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

D. Both (A) and (R) are incorrect .

Answer: D

Watch Video Solution

25. Assertion$Cu^{\oplus}$ ion is unstable in aqueous solution, whereas Fe^{2+} ion is stable

$Cu^{\oplus}$ disproportionate in aqueous 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 and (R) is the correct explanation of (A) .

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

D. Both (A) and (R) are incorrect .

Answer: A

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Exercises Integer (Naming And Terminology)

1. Give the number of ligand(s) in which donor atoms is only $NNH_2CH_2COO^{\Theta}$, en, dinen, Py, $EDTA$,ph .

Watch Video Solution

2. Give number of non-classical ligands which are negative ligands $CN^{\Theta}, S_2O_3^{2-}, C_3H_5^{\Theta}, C_5H_5^{\Theta}$.

Watch Video Solution

3. Give the number of ligand which are monodentate as well as ambidentate

$C_3^{2-}, CH_3COO^{\ominus}, X^{\ominus}, H^{\ominus}, SO_4^{2-}$.

Watch Video Solution

4. Give the number of ligands which are monodentate as well as ambidentate

$\overset{\ominus}{C}N, C_2O_4^{2-}, S_2^{2-}, NO_2^{\ominus}, \overset{\ominus}{O}CN, SCN^{\ominus}$.

Watch Video Solution

5. Give the number of strong field ligand(s) from the following

$NH_3, en, CI^{\ominus}, CH_3COO^{\ominus}, \overset{\ominus}{C}N, CO, NO_2^{\ominus}$.

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6. Give the number of weak filed ligand (s) from the following

$S^2, OH, CI^{\Theta}, \overset{\Theta}{H_2}\Theta, NO_3\Theta$ ..

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7. The sum of primary and secondary valencies of chromium in the complex $CrBr_3.6NH_3$ is .

Watch Video Solution

8. Find the number of ligand (s) which is//are polydentate ligand

$en, C_2O_4^{2-}$ acac, DMG gly,ph .

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9. Find the number of ligand (s) which is//are polydentate ligand

$en, dmgdien$EDTA\` .

Watch Video Solution

10. How many corrdinated water molecule(s) is//are present in brown ring complex ? .

Watch Video Solution

11. Sodium nitroprusside is used to test S^{2-} ion How many CN^{Θ} ion acts as ligand in the compound .

Watch Video Solution

12. Give the number of ligand(s) which is//are non-classical ligand

$S^{\Theta}CN, \overset{\Theta}{O}CN, S_2O_3^{2-}, C_2O_4^{2-}, S^{2-}$.

Watch Video Solution

13. Give the number of ligand(s) which is//are non-classical ligand

$CO, NO, c_2H - (4), C_3H_5\Theta, H^{\Theta}$.

Watch Video Solution

14. Give the number of ligand(s) which are non-classical ligand

$CO, NO, C_2H_4, C_3H_5\Theta, H^{\Theta}$.

Watch Video Solution

15. Give the number of ligand(s) which is/are non-classical ligand an π donor as well as pi acceptor ligand

$CO, PH_3, PF_3, C_3H_5^{\Theta}, C_5H_5\Theta$.

Watch Video Solution

16. What are the values of m and n in the anionic species $\left[V(CO)_m\right]^{n-}$ if it is flowing Sidwick EAN rule and having octahedral shape ? .

Watch Video Solution

Exercises Integer (Isomerism)

1. Give the total number of possible isomers of $\left[ZnBr_2F_2\right]^{2-}$.

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2. Give the number of pair enantiomer of $\left[Ma_2b_2cd\right]$.

Watch Video Solution

3. Give the total number of isomer of $\left[Be(gly)_2\right]$

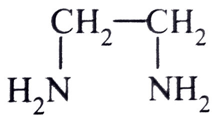
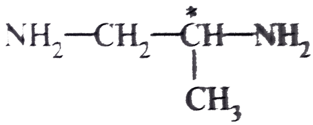
Watch Video Solution

4. How many pairs of enantiomers are possible for $[M(AA)(BC)de]$? .

Watch Video Solution

5. Find the number of geometrical isomers in $\left[Co(en)(Pn)\left(NO_2\right)_2\right]$

$[Co(en)(Pn)\ (NO_2)_2]$.

en =  pn = 

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6. Write the sum of geometrical isomers in

$\left[Pt\left(H_2N - CH\left(CN_3\right) - CO\overset{\ominus}{O}\right)_2\right]$ complex and stereoisomers of $\left[Pt(gly)_3\right]^{\oplus}$ complex .

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7. Write the sum of geometrical isomers in $\left[Ma_2b_2c_2\right]$ complex and stereoisomers in $\left[M(AB)_3\right]$ complex .

Watch Video Solution

8. Give the ration of geometrical isomers in $\left[M(AA)_2b_2\right]$ and optical isomers of $\left[M(AA)_3\right]$.

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9. Give the number of geometrical isomers in $\left[Pt(gly)_2\right]$.

Watch Video Solution

10. Give the total number of possible isomers of $\left[Co1_2(CN)\left(NH_3\right)en\right]$.

Watch Video Solution

11. Give the number of possibel isomers of

$\left[CrCI_2en_2\right]^{\oplus}$.

Watch Video Solution

12. Give the total number of possible structural isomers of the compound $\overset{II}{(CU)}\left(NH_3\right)_4\left[\overset{II}{Pt1_4}\right]$.

Watch Video Solution

13. Give the number of total possible ionisation isomers in $\left[Pt\left(NH_3\right)_4CI_2\right]Br_2$.

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14. Give the number of total possible ionisation isomers in $\left[Pt\left(NH_3\right)_4CI_2\right]Br_2$.

Watch Video Solution

15. Give the ratio of trans- isomers is $\left[M\left(Aab_2c_2\right]\right.$(A) and $\left[Ma_4b_2\right](B)$ respectively .

Watch Video Solution

Exercises Integer (Hybridisation , Vbt , Cft And Application)

1. In hexacyanidomanganate(II) ion the Mn atom assumes d^2sp^3-hybrid sates. Then the number of unpaired electrons in the complex is .

Watch Video Solution

2. Give the number of unpaired electron(s) in the complex ion $[CoCI_6]^{3-}$.

Watch Video Solution

3. Predict the number of unpaired electrons in a tetrahedral d^6 ion and in a square planar d^7 ion .

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4. Give the number of unpaired electron present in the d-orbitals (whose lobes are present along the axis) for the complex $[Co(SCN)_4]^{2-}$.

Watch Video Solution

5. Give the number of $3d$ electrons occupied in t_{2g} orbitals of hydrated Cr^{3+} ion (octahedral) .

Watch Video Solution

6. How many unpaired electrons are present in e_g orbital of $MnO_4\Theta$.

Watch Video Solution

7. How many electrons are present in d_{z2} orbital of $\left[Ni(gly)_2\right]$? .

Watch Video Solution

8. Give the total number of t_{2g} and e_g electrons in $\left[NiF_6\right]^{2-}$.

Watch Video Solution

9. How many electrons are present in d-orbitals which are present along the axis in $\left[Ti\left(H_2O\right)_6\right]^{3+}$?.

Watch Video Solution

10. If Hund' s rule is violated then how many unpaired electrons are present I n $\left[Cr\left(NH_3\right)_6\right]^{3+}$ complex ion ?.

Watch Video Solution

11. Give the number of unpaired electrons in t_{2g} set of d-orbitals in $\left[Co\left(H_2O\right)_3F_3\right]$ complex.

Watch Video Solution

12. How many maximum atom (s)is//are are present in same plane of $Cr(CO)_6$? .

Watch Video Solution

13. Find out the number of hydrogen bonds present in the structure of the nickel dimethylglyoxime complex .

Watch Video Solution

Exercises Fill The Blanks

1. In a coordination complex the negative groups or neutral molecules attached to the central atoms are termed as ______ .

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2. According to Werner' s coordination theory, there are two kinds of valence primary or _____ and secondary or ____The former type of valency is _____while the latter type is_____ .

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3. A ligand is termed as monodentate, didentate etc, depending upon the________ present in it .

Watch Video Solution

4. The number of ligands attached to the central atom is termed the _________of the central atom .

Watch Video Solution

5. The total number of electrons on the central atom including those gained by bonding is called the______ abbreviated as______ .

Watch Video Solution

6. Coordination isomerism occurs when both cation and anion are______ .

Watch Video Solution

7. The magnitude of stability constant gives an indication of the stability of _____in___ .

Watch Video Solution

8. Under the influence of strong the ligands the electrons can be forced_____against the____ rule of________ .

Watch Video Solution

9. d_{x2}, d_{yz} and d_{zx} orbitals have______ energies and are collectively termed_______ or ________or_________orbitals .

Watch Video Solution

10. d_{xy}, d_{yz} and d_{zx} orbitals have______ energies and are collectively termed_______ or ________orbitals .

Watch Video Solution

11. Organometallic compounds are those compounds which contain one or more__________ .

Watch Video Solution

12. d^2sp^3 hybridisation of the central atom gives the _____orbital complex while sp^3d^2 hybridisation gives the_______orbital complex .

Watch Video Solution

13. Wilkinson's catalyst, unsed as a catalyst in the hydrogenation of alkene is________and is an example of _____catalysis .

Watch Video Solution

14. Recently the platinum complex known as cisplatin has been found in the treatment of _______and is represented as_____ .

Watch Video Solution

15. Ziegker-Natta catalyst, used as a catalyst for the low temperature polmerisation al alkene is an example of_______catalysis and is represented as_____ .

Watch Video Solution

16. Zeisse's-salt Ferrocene and Dibenzene chromium are the example of _______bonded organometallic compounds and are called_________ .

Watch Video Solution

17. Calcium dihydrogen salt of $EDTA$ is used as an antidote for the poisoning of_______.

Watch Video Solution

18. $\left[Co\left(NH_3\right)_5SO_4\right]Br$ and $\left[Co\left(NH_3\right)_5Br\right]SO_4$ shown _______isomerism .

Watch Video Solution

19. According to valence bond theory the geometry of $\left[Ni(CO)_4\right]$ is_______ .

Watch Video Solution

20. $K_4Fe(CO)_6$ is considered to a be a complex but potash alum is____and bleaching powder is _______ .

Watch Video Solution

21. Grignard reagent is a ______organometaollic compound .

Watch Video Solution

22. $\left[Co\left(NH_3\right)_6\right]^{3+}$ is diamagnetic while $\left[CoF_6\right]^{3-}$ is____ .

Watch Video Solution

23. $[ptabcd]^{n\pm}$ has________shape and has _____geometrical isomers .

Watch Video Solution

24. Geomerical isomerism is not observed in complexes of coordination number 4 of__________geometry .

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25. Trans form of $\left[M(\forall)_2a_2\right]^{n+}$ complex does not show _______isomerism .

Watch Video Solution

26. Dimethylglyoxime is used from the gravimetic estimation of _____ion .

Watch Video Solution

27. $EDTA$ is used as a complexing agent in __________estimation of metal ions like Ca^{2+}, M^{2+} and Zn^{2+} ions .

Watch Video Solution

28. Potassium hexanitrocobaltate III $K_3\left[Co\left(NO_2\right)_6\right]$ is called _______.

Watch Video Solution

29. Haemoglobin is a complex of______ chlorophyll is a complex of______ and vitamin B_{12} is a complex of_______ .

Watch Video Solution

30. Organo arsenic compounds are used ar remedy for ____________.

Watch Video Solution

31. ________ is used to prevent the infection of young plants .

Watch Video Solution

32. _______ is an important anti knock compound added to petrol used in internal combustion engines .

Watch Video Solution

Exercises True/False

1. A biodentate ligand has 3 coordination sites .

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2. Tetrahedral complex cannot show geometrical isomerism .

Watch Video Solution

3. Coordination number and oxidation state of a metal means the same thing .

Watch Video Solution

4. Coordination compounds are mainly known for transition metals .

Watch Video Solution

5. Ambidentate ligands can show linkage isomerism .

Watch Video Solution

6. $Fe(CO)_5$ has htrigonal bipyramidal geometry .

Watch Video Solution

7. Valence bond theory explains the geometry and magnetic nature of the coordination compounds .

Watch Video Solution

8. Valence bond theory explains the colour of the coordination compounds .

Watch Video Solution

9. Stability of coordination compounds increases with increase in charge density of the metal ions .

Watch Video Solution

10. $\left[NiCI_4\right]^{2-}$ is diamagnetic in nature .

Watch Video Solution

11. The pair $\left[Cr\left(H_2O\right)_6\right]CI_3$ and $\left[Cr\left(H_2O\right)_4CI_2\right]CI.\,H_2O$ shows ionisation isomerism .

Watch Video Solution

12. EAN rule is followed by $K_4Fe(CN)_6$ complex .

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13. $A1_2\left(CH_3\right)_6$ is a dimeric compound and has a structure similar to diborane .

Watch Video Solution

14. Carbonyls are organometallic compounds .

Watch Video Solution

Archives (Linked Comprehension)

1. The coordination number of Ni^{2+} is 4

$NiCI_2 + KCN$ (excess)rarr$A$ (cyano complex)

$NiCI_2 + conc. HCI$ (excess) rarr B (Chloro complex)

The $IUPAC$ name of A and B are .

A. potassium tetracyanonickelate(II),potassium tetrachloronickelate(II) .

B. tetracyanopotassiumnickelate(II)tetrrachloropotassiumnickelate(II)
.

C. tetracyanonickel(II) tetrachloronickel(II)

D. potassium tetracyanonickel(II),tetracholoronickel(II) .

Answer: a

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2. The coordination number of Ni^{2+} is 4

$NiCI_2 + KCN$ (excess)rarr$A$ (cyano complex)

Predict the magnetic nature of A and B .

A. Both are diamagnetic .

B. A is diamagnetic and B is paramagnetic with one unpaired electron .

C. A is diamagnetic and B is paramagnetic with two unpaired electrons .

D. Both are paramagnetic .

Answer: b

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3. The coordination number of Ni^{2+} is 4

$NiCI_2 + KCN$ (excess)rarr$A$ (cyano complex)

The hybridisation of A and B are .

A. dsp^2, sp^3

B. sp^3, sp^3

C. dsp^2, dsp^2

D. sp^3, d^2, d^2sp^3 .

Answer: a

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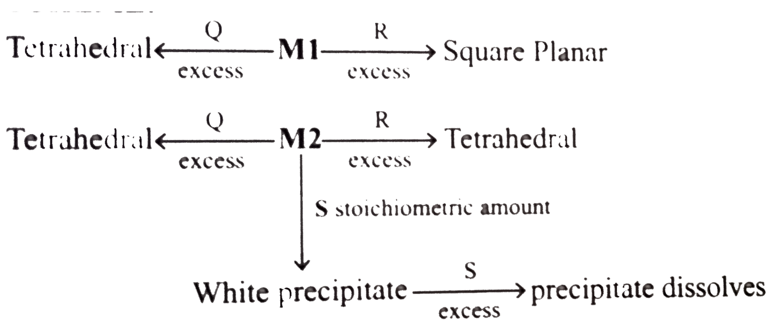
4. An aqueous solution of metal ion MI reacts separately with reagents Q and R in excess to give tetrahedral and square planar complexes, respectively An aqueous solution of another metal ion $M2$ always forms tetrahedral complexs with theses reagents. Aqueous solution of $M2$ on reaction with reagent S gives white precipitate which dissolves in excess of S The reactions are summarised in the scheme given below: SCHEME :



A. Zn^{2+}, KCN and HCI .

B. Ni^{2+}, HCI and KCN .

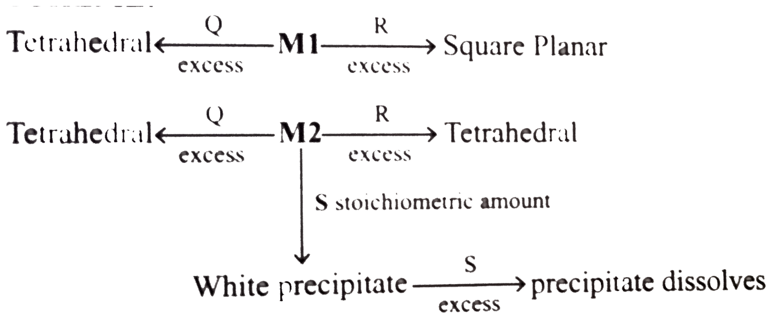
C. Cd^{2+}, KCN and HCI

D. Co^{2+}, HCI and KCN

Answer: b

Watch Video Solution

5. An aqueous solution of metal ion MI reacts separately with reagents Q and R in excess to give tetrahedral and square planar complexes, respectively An aqueous solution of another metal ion $M2$ always forms tetrahedral complexs with theses reagents. Aqueous solution of $M2$ on reaction with reagent S gives white precipitate which dissolves in excess of S The reactions are summarised in the scheme given below: $SCHEME$:



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

B. Na_2HPO_4

C. K_2CrO_4

D. KOH

Answer: Double salt

Watch Video Solution

Archives Multiple Correct

1. The pair of coordination complexes//ion exhibiting the same kind of isomerism is (are) .

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

B. b. $\left[Co\left(NH_3\right)_4Cl_2\right]^{\oplus}$ and $\left[Pt\left(NH_3\right)_2\left(H_2O\right)Cl\right]^{\oplus}$

C. c. $\left[CoBr_2Cl_2\right]^{2-}$ and $\left[PtBr_2Cl_2\right]^{2-}$

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

Answer: b,d

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Archives Single Correct

1. Among $ni(CO)_4$, $\left[Ni(CN)_4\right]^{2-}$ and $NiCI_4^{2-}$.

A. $ni(CO)_4$ and $NiCI_4^{2-}$ are diamagnetic and $[Ni(CN)_4]^{2-}$ is paramagnetic .

B. $NiCI_4^{2-}$ and $[Ni(CN)_4^{2-}$ are diamagnetic and $Ni(CO)_4$ is paramagnetic .

C. $NiCI_4^{2-}$ and $[Ni(CN)_4^{2-}$ are diamagnetic and $[Ni(CO)_4^{2-}$ is paramagnetic .

D. $Ni(CO)_4$ is diamagnetic and $NiCI_4^{2-}$ and $[Ni(CN)_4]^{2-}$ are paramagnetic .

Answer: c

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2. Among the following ions which has the highest paramagntism ? .

A. $[Cr(H_2O)_6]^{3+}$

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

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

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

Answer: b

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3. Which of the following is formed when excess of KCN is added to an aqueous solution of copper sulphate?

A. $Cu(CN)_2$

B. $K_2\left[Cu(CN)_4\right]$

C. $K\left[Cu(CN)_2\right]$

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

Answer: Double salt

Watch Video Solution

4. The geometries of $Ni(CO)_4$ and $Ni\left(PPh_3\right)_2CI_2$ are .

A. Both square planar

B. Tetrahedral and square planar,respectively

C. Both tetrahedral

D. Square planar and tetrahedral,respectively

Answer: c

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5. Among the following identify the species with an atom in $+6$ oxidation state: .

A. MnO_4^{Θ}

B. $Cr(CN)_6^{3-}$

C. NiF_6^{2-}

D. CrO_2CI_2

Answer: Double salt

Watch Video Solution

6. The complex which has no d-electron in the central metal atom is .

A. $\left[MnO_4\right]^{\Theta}$

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

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

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

Answer: a

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

A. $MnO_2, FeCI_3$

B. $\left[MnO_4\right]^{\Theta}, CrO_2CI_2$

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

D. $\left[NiCI_4\right]^{2-}, \left[CoCI_4\right]^{\Theta}$

Answer: b

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8. The compound having a tetrahedral geometry is .

A. $\left[Ni\left(CN_4\right)\right]^{2-}$

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

C. $\left[PdCI_4\right]^{2-}$

D. $\left[NiCI_4\right]^{2-}$

Answer: Double salt

Watch Video Solution

9. The spin magnetic moment of cobalt in the compound $Hg\left[Co(SCN)_4\right]$ is

A. $\sqrt{3}$

B. $\sqrt{15}$

C. $\sqrt{24}$

D. $\sqrt{8}$

Answer: b

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10. Which kind of isomerism is exhibited by octahedral $Co(NH_3)_4Br_2CI$? .

A. geometrical and ionisation

B. geometrical and optical

C. optical and ionisation

D. geometrical only

Answer: a

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11. The bond length of C - O bond in carbon monoxide is $1.128A$ The C - O bond length in $[Fe(CO)_5]$ is .

A. $1.15A$

B. $1.128A$

C. $1.13A$

D. $1.118A$

Answer: c

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12. Among the following metal carbonyls the $C - O$ bond order is lowest in .

A. $\left[Mn(CO)_6\right]^{\oplus}$

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

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

D. $\left[V(CO)_6\right]^{\ominus}$

Answer: b

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13. Both $[Ni(CO)_4]$ and $[Ni(CN)_4]^{2-}$ are diamagnetic The hybridisations of nickel in these complexes , respectively are :

A. sp^3, sp^3

B. sp^3, dsp^2

C. dsp^2, sp^3

D. dsp^2, dsp^2

Answer: b

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14. The $IUPAC$ name of $[Ni(NH_3)_4][NiCI_4]$ is .

A. tetrachloronickel (II)-tetraaminenickel(II)

B. tetrachloronickel (II)-tetraaminenickel(II)

C. tetrachloronickel (II)-tetraaminenickel(II)

D. tetrachloronickel (II)-tetraaminenickel(II)

Answer: c

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15. Among the following the coloured compound is .

A. $CuCI$

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

C. CuF_2

D. $\left[Cu\left(CH_3CN\right)_4\right]BF_4$

Answer: c

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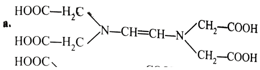
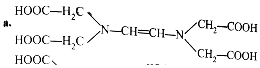
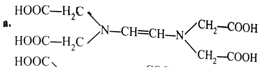
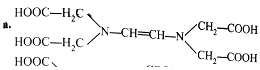
16. The correct structure of ethylenediamineteraacetic acid ($EDTA$) is

.

A. 

B. 

C. 

D. 

Answer: c

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17. The ionisation isomer of $\left[Cr\left(H_2O\right)_4CI\left(NO_2\right)\right]CI$ is .

A. $\left[Cr\left(H_2O\right)_4\left(O_2N\right)\right]CI_2$

B. $\left[Cr\left(H_2O\right)_4CI_2\right]\left(NO_2\right.$

C. $\left[Cr\left(H_2O\right)_4CI(ONO)\right]CI$

D. $\left[Cr\left(H_2O\right)_4CI_2\left(NO_2\right)\right]H_2O$

Answer: b

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18. The complex showing a spin -magnetic momnet of $2.82BM$ is .

A. $Ni(CO)_4$

B. $\left[NiCI_4\right]^{2-}$

C. $Ni\left(PPh_3\right)_4$

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

Answer: d

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19. Geometrical shapes of the complews formed by the reaction of Ni^{2+} with CI^{Θ}, CN^{Θ} and H_2O respectively ,are .

A. Octahedral tetrahedral and square planar

B. Tetrahedral,square planar and octahedral

C. Square planar,tetrahedral,octahedral

D. Octahedral,square palnar and octahedral

Answer: b

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20. Among the following complexes $(K - P)$

$K_3[Fe(CN)_6](K)$, $[Co(Nh_3)_6]CI_3(L)$

$Na_3[Co(\otimes alate)_3](M)$, $[Ni(H_2O)_6]CI_2(N)$

$\left[Pt(CN)_4\right](O)$ and $\left[Zn\left(H_2O\right)_6\left(NO_3 - (2)(P)\right.\right.$

The diamagnetic are .

A. K, L, M, N

B. K, M, O, P

C. L, M, O, P

D. L, M, N, O

Answer: c

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21. As per $IUPAC$ nomenclature, the name of complex $\left[Co\left(H_2O\right)_4\left(NH_3\right)_2\right]CI_3$ is .

A. Tetaaquadiaminecobalt(III) chloride .

B. Tetaaquadiaminecobalt(III) chloride .

C. Tetaaquadiaminecobalt(III) chloride .

D. Tetaaquadiaminecobalt(III) chloride .

Answer: d

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22. The colour of light absobed by an aqueous solution of $CuSO_4$ is

A. orange-red

B. blue-green

C. yellow

D. violet

Answer: a

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23. $\left[NiCI_2\left\{P\left(C_2H_5\right)_2\left(C_6H_5\right)\right\}_2\right]$ 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 tetrahedral

Answer: c

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24. Which of the following complex species is not expected to exhibit optical isomerism ?

A. $\left[Co(en)_2CI_2\right]^{\oplus}$

B. $\left[Co\left(NH_3\right)_3CI_3\right]$

C. $\left[Co(en)\left(NH_3\right)_2CI_2\right]^{\oplus}$

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

Answer: b

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25. Consider the follwing complexes ion P, Q and R

$P = \left[FeF_6\right]^{3-}$, $Q = \left[V\left(H_2O\right)_6\right]^{2+}$ and $R = \left[Fe\left(H_2O\right)_6\right]^{2+}$

The correct order of the complex ions, according to their spin only magnetic moment values (inBM) is .

A. $R < Q > R$

B. $Q < R < P$

C. $R < P < Q$

D. $Q < P < R$

Answer: b

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26. 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 $AgCI$ precipitated would be .

A. 0.003

B. 0.01

C. 0.0001

D. 0.002

Answer: c

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27. The octahedral complex of a metal ion M^{3+} with four monodentate ligands L_1, L_2, L_3 and L_4 absorb wavelengths in the region of red,green, yellow and bule, respectively The increasing order of ligand strengh of the four ligands is

A. $L_3 < L_2 < L_4 < L_1$

B. $L_1 < L_2 < L_4 < L_3$

C. $L_4 < L_3 < L_2 < L_1$

D. $L_1 < L_3 < L_2 < L_4$

Answer: d

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28. The equation which is balanced and represents the correct product(s) is .

A. $\left[Mg\left(H_2O\right)_6\right]^{2+} + (EDTA)^{4-} \xrightarrow{ExcessNaOH} [Mg(EDTA)]^{2+} + 6H_2O$

B. $CuSO_4 + 4KCN \rightarrow K_2\left[Cu(CN)_4\right] + K_2SO_4$

C. $Li_2O + 2KCI \rightarrow 2LiCI + K_2O$

D. $\left[CuCI\left(NH_3\right)_5\right]^{\oplus} + 5H^{\oplus} \rightarrow Co^{2+} + 5NH_4^{\oplus} + CI^{\ominus}$

Answer: d

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Archives Assertion Reasoning

1. Statement I $\left[Fe\left(H_2O\right)_5NO\right]SO_4$ is paramagnetic

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

A. Stament I is true, Statement II is also true Statement II is a correct explanation for Statement I .

B. Statement I is true Statement II is false.

C. Statement I is false, Statement II is true .

D.

Answer: a

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2. Statement-1: The geometrical isomers of the complex $\left[M\left(NH_3\right)_4Cl_2\right]$ are optically inactive.

Statement-2: Both geometrical isomers of the complex $\left[M\left[NH_3\right)_4Cl_2\right]$ possess axis of symmetry.

A. Stament I is true, Statement II is also true Statement II is a correct explanation for Statement I .

B. Statement I is true Statement II is false.

C. Statement I is false, Statement II is true .

D. Stament I is true, Statement II is also true Statement II is not a correct explanation for Statement I .

Answer: a

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Archives Integer

1. The volume (in mL) of $0.1 M AgNO_3$ required for complete precipitation of chloride ions present in $30 mL$ of $0.01 M$ solution of $\left[Cr\left(H_2O\right)_5 Cl\right]Cl_2$, as silver chloride is close to:

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2. $EDTA^{4-}$ i9s ethylenediamine tetraacetate ion The total number of $N - CO - O$ bond angles in $[Co(EDTA)]^{-1}$ complex ion is .

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Archives Fill The Blanks

1. AgCI dissolves in excess of KCN solution to give the ___complex compound .

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2. The type of magnetism exhibited by $\left[Mo\left(H_2O\right)_6\right]^{2+}$ ion is ______.

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3. The $IUPAC$ name of $\left[CO\left(NH_2\right)_6\right]CI_3$ is______ .

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Archives True/False

1. Both potassium ferrocyanide and potassium ferricyanide are diamagnetic .

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Archives Subjective

1. Write the balanced chemical equations for the following "Potassium ferricyanide reacts with hydrogen peroxide in basic solution" .

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2. Give reasons in two or three sentences only for the following

"The species $\left[CuCI_4\right]^{2-}$ exitsts, while $\left[CuI_4\right]^{2-}$ does not" .

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3. The acidic aqueous solution of ferrous ion forms a brown complex in the presence of NO_3^{Θ} by the follwing two steps:

$$\left[Fe\left(H_2O\right)_6\right]^{2+} + NO_3^{\Theta} + H^{\oplus} \rightarrow \ldots + \left[Fe\left(H_2O\right)_6\right]^{3+} + H_2O$$

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

Complete and balance the equations .

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4. Identify the complex which are expected to be coloured Explain

(a) $\left[Ti\left(NO_3\right)_4\right]$

(b) $\left[Cu\left(NCH_3\right)\right]^{\oplus} BF_4^{\ominus}$

(c) $\left[Cr\left(NH_3\right)_6\right]^{3+} 3CI^{\ominus}$

(d) $K_3\left[VF_6\right]$.

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5. Write the $IUPAC$ name for the following compounds

(a) $\left[Co\left(NH_3\right)_5 ONO\right]Cl_2$

(b) $K_3\left[Cr(CN)_6\right]$.

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6. Write the $IUPAC$ name for $\left[Cr\left(NH_3\right)_5 CO_3\right]CI$.

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7. Write a balanced equation for the reaction of argentite with KCN and name the products in the solution .

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8. Write the formulae of the following complexes

(a) Pentamminechlorocobalt(III) ion

(b) Lithiumtetrahydridoaluminate(III) .

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9. A, B and C are three complexes of chromium(III) with the empirical formula $H_{12}O_6C_{13}Cr$ All the three complexes not react with concentrated H_2SO_4 whereas complexes B and C lose 6.75% and

13.5% of their original mass respectively, on treatment on treatment with conectrated H_2SO_4 Identify A, B and C .

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10. An aqueous solution containing 1 mol of HgI_2 and $2mol$ of NaI is orange in colour. On addition of excess NaI the solution becomes colourless The orange colour reappears on subsequent addition of Na OCI Explain with equations .

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11. Draw the structures of $\left[Co\left(NH_3\right)_6\right]^{3+}, \left[Ni(CN)_4\right]^{2-}$ and $\left[Ni(CO)_4\right]$ Write the hybridisation of atomic orbitals of the transition metal in each case .

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12. A metal complex having composition $Cr(NH_3)_4CI_2$ Br has been isolated in two forms A and B The A reacts with $AgNO_3$ to give a white precipitate readily soluble in dilute queous ammonia, whereas B gives a pale-yellow precipitate soluble in concentrated ammonia Write the formula of A and B and state the hybridisation of chromium in each. Calculate their magnetic moment (spin only value) .

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13. Dedue the structures of $[NiCI_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ considering the hybridisation of the metal ion Calulate the magnetic moment(spin only) of the species .

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14. Write the $IUPAC$ nomenclature of the given complex along with its hybridisation and structure

$K_2\left[Cr(NO)\left(NH_3\right)(CN)_4\right], \mu = 1.73. BM$.

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15. $NiCI_2$ in the presence of dimethy1 glyoxime(DMG) gives a complex which precipitates in the presence of NH_4OH giving a bright red colour .

(a) Draw its structure and show H bonding

(b) Give the oxidation state of Ni and its hybridisation

(c) Predict whether it is paramagnetic or dimagnetic .

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16. AIF_3 is insoluble in anhydrous HF but when little KF is added to the compound it becomes soluble On addition of BF_3, AIF_3 precipitated Write the balanced chemical equations .

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17. Write the balanced chemical equations for developing a black and white photographic film Also, give the reason as to why the solution of sodium thiosulphate on acidification turns milky white and give the balanced chemical equation of this reaction .

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18. $Fe^{3+} \xrightarrow{SNC^{\Theta}(\text{Excess})} A\text{Bloodred} \xrightarrow{F^{\Theta Excess}} B\text{Colourless}$

Identify A and B

(a) Write the $IUPAC$ name of A and B

(b) Find out the spin only magnetic moment of B .

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