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Email: info@askiitians.com
Tel: 1800-2000-838

Class: 12
Subject: chemistry
Topic: Coordination compound
No. of Questions: 25

1)The ligand (en) is an example of a

a. monodentate ligand
b. bidentate ligand
c. tridentate ligand
d. hexadentate ligand

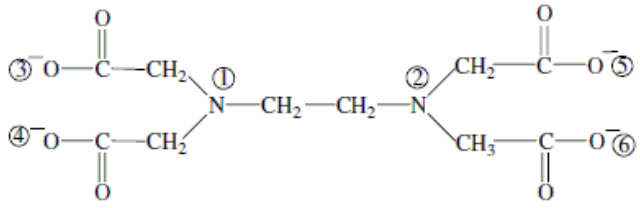
Sol. (b) Ethylenediamine (en) is an example of a bidentate ligand

2)Ethylenediaminetetracetate ion is a

a. bidentate ligand
b. tetradentate ligand
c. pentadentate ligand
d. hexadentate ligand

Sol. (d)

Ethylenediaminetetracetate ion is hexadentate.



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3)The number of unpaired electrons associated with Ni in the complex $[Ni(NH_3)_6]^{2+}$ is

a. one
b. two
c. three
d. zero

Sol. (b) Calculate the oxidation no. of Ni first and then it can be seen that its having two unpaired e-.

4)The coordination number of Co in the complex compound $[Co(NH_3)_6]Cl_3$ is

a. 6
b. 8
c. 9
d. 10

Sol. (a) A Co is surrounded by 6 NH_3 molecules.

5)A complex involving dsp^2 hybridization has

a. a square planar geometry
b. a tetrahedral geometry
c. an octahedral geometry
d. trigonal planar geometry

Sol. (a) dsp^2 hybridization gives square planar geometry.

6) Which of the following statements is not correct?

a. The complexes $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ differ in the state of hybridization of nickel.
b. The complexes $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ differ in the magnetic properties.
c. The complexes $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ differ in the geometry.
d. The complexes $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ differ in primary valencies of nickel

Sol.(d) The complexes $[NiCl_4]^{2-}$ AND $[Ni(CN)_4)^{2-}$ have the same primary valency.

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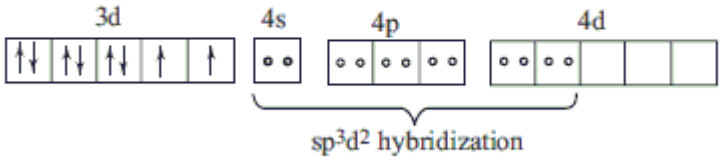
7)The complex $[Ni(NH3)_6]^{4-}$ involves

a. sp^3 hybridization
b. dsp^3 hybridization
c. d^2sp^3 hybridization
d. sp^3d^2 hybridization

Sol. (d)

Ni^{2+} $(3d^8)$ ion in the given complex involves sp^3d^2 hybridization.



8)The IUPAC name of $[Ni(CO)_4]$ is

a. tetracarbonylnickel(II)
b. tetracarbonylnickel(0)
c. tetracarbonylnickel(II)
d. tetracarbonylnickelate(0)

Sol.(b) fact

9)The IUPAC name of the complex $[Ni(NH_3)_4]$ $[NiCl_4]$ is

a. tetrachloronickel(II)-tetraamminenickel(II)
b. tetraamminenickel(II)-tetrachloronickel(II)
c. tetraamminenickel(II)-tetrachloronickelate(II)
d. tetrachloronickel(II)-tetraamminenickelate(II)

Sol. (c) by nomenclature it is clear.

10)Which of the following complexes is diamagnetic in nature?

a. $[CoF_6]^{3-}$
b. $[NiCl_4]^{2-}$
c. $[Ni(NH_3)_6]^{2+}$
d. $[Ni(CN)_4]^{2-}$

Sol.(d) $[Ni(CN)_4]^{2-}$ does not possess unpaired electrons.

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11)The number of unpaired electrons associated with Cr in the complex $[Cr(CN)_6]^{4-}$ is

a. zero
b. one
c. two
d. four

Sol.(c) Cr is in +4 Oxidation state with two unpaired electrons.

12) Which of the following square-planar complexes shows cis-trans isomerism?

a. $PtCl_4^{2-}$
b. $PtCl_3NH_3^-$
c. $PtCl_2(CN)_2^{2-}$
d. $PtCl_2(en)$

Sol. (c) fact

13)The total number of possible isomers (cis-trans and optical) of $CrCl_2en_2^+$ is

a. 1
b. 2
c. 3
d. 4

Sol.(c) fact

14)The compound $[Co(NH_3)_2 (en) Cl_2]$ can form

a. linkage isomers
b. coordination isomers
c. optical isomers
d. linkage as well as optical isomers

Sol .(c) Its coordination isomers where Cl can replace NH_3.

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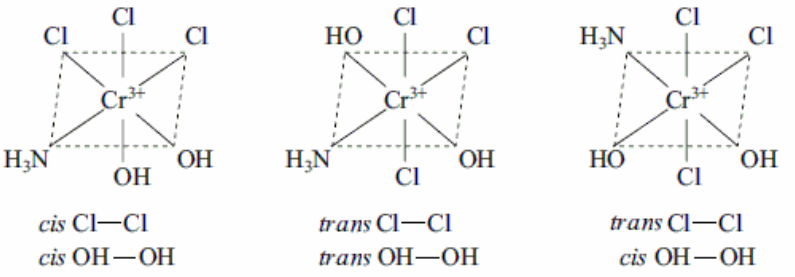
15)The number of geometrical isomers of $[Cr(NH_3)(OH)_2Cl_3]^{2-}$ ion is

a. 1
b. 2
c. 3
d. 4

Sol. (c)

There are three geometrical isomers:



cis Cl—Cl
cis OH—OH

trans Cl—Cl
trans OH—OH

trans Cl—Cl
cis OH—OH

16) Chlorophyll is a/an
a..magnesium complex
b. cobalt complex
c. iron complex
d. chromium complex

Sol. (a) fact

17) Haemoglobin is a/an

a. iron(II) complex
b. cobalt(III) complex
c. magnesium(II) complex
d. chromium(II) complex

Sol.(a) fact

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18) Vitamin B_{12} is a complex of

a. cobalt(II) ion
b. cobalt(III) ion
c. chromium(II) ion
d. chromium(III) ion

Sol.(b). Vitamin B_{12} is a complex of cobalt(III) ion.

19)Wilkinson's catalyst used as a homogeneous catalyst in hydrogenation of alkene contains

a. iron
b. aluminium
c. rhodium
d. cobalt

Sol.(c). Wilkinson's catalyst contains rhodium
.

20) Which of the following orders of ligands in spectrochemical series is correct?

a. $SCN < F^- < CN^-$
b. $SCN^- < CN^- < F^-$
c. $F^- < SCN^- < CN^-$
d. $F^- < SCN^- < CN^-$

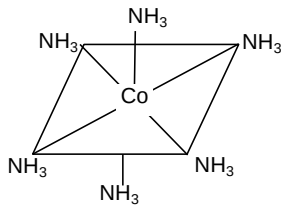
Sol.(a)The order is $SCN^- < F^- < CN^-$.

21) Why does Mn (II) show maximum paramagnetic character amongst the bivalent ions of the first transition series?

Sol. Mn^{+2} has maximum number of unpaired electrons.

22) Draw the structures of $[Co(NH_3)_6]^{3+}$, $[Ni(CN)_4]^{2-}$ and $[Ni(CO)_4]$. Write the hybridisation of atomic orbitals of the transition metal in each case.

Sol. Hybridization of Co^{+3} is d^2sp^3, shape is octahedral



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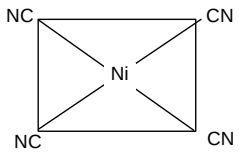
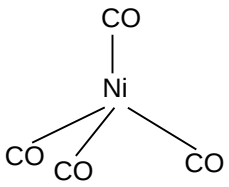
Hybridization of Ni^{+2} is dsp^2 so shape is square planar.



Hybridisation of Ni is sp^3 so shape is tetrahedral



23) *A metal complex having composition $Cr(NH_3)_4Cl_2Br$ has been isolated in two forms A and B. The form A reacts with $AgNO_3$ to give a white precipitate readily soluble in dilute aqueous ammonia, whereas B gives a pale yellow precipitate soluble in concentrated ammonia. Write the formula of A and B and state the hybridisation of chromium in each. Calculate their magnetic moments (spin - only value).*

Sol. Formula of A is $[Cr(NH_3)_4ClBr]Cl + AgNO_3 \longrightarrow AgCl\downarrow$ (white)

Formula of B is $[Cr(NH_3)_4Cl_2]Br + AgNO_3 \longrightarrow AgBr\downarrow$ (yellow)

Cr is in +3 oxidation state i.e. $3d^3$ system.

Therefore the hybridisation of Cr is d^2sp^3 and spin only magnetic moment.

$$\mu_s = \sqrt{n(n+2)}BM$$

$$\mu_s = \sqrt{3(3+2)}BM = 3.87 \quad BM$$

24) K_2 Pt Cl_6 is well known compound whereas corresponding Ni compound is not known. State a reason for it.

Sol. This is because Pt^{4+} is more stable than Ni^{4+} as the sum of four ionization energies of Pt is less than that of Ni.

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25)Deduce the structures of $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ considering the hybridization of the metal ion. Calculate the magnetic moment (spin only) of the species.

Sol. $[NiCl_4]^{2-}$ $\Rightarrow sp^3$ (as Cl^- is weak field ligand) – Tetrahedral

$[Ni(CN)_4]^{2-}$ $\Rightarrow dsp^2$ (as CN^- is strong field ligand) – Square planar

Magnetic moments (μ_{spin}) values are as follows,

$[NiCl_4]^{2-}$ $\Rightarrow \sqrt{2(2+2)}$ = 2.82 B.M.

$[Ni(CN)_4]^{2-} \Rightarrow \sqrt{0(0+2)}$ = 0.0 B.M.