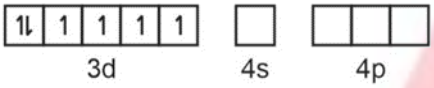
S1. Ans.(d)

A	$[Co(NH_3)_5(NO_2)]Cl_2$	II	Linkage isomerism due to 'N' and 'O' linkage by NO_2
B	$[Co(NH_3)_5(SO_4)]Br$	III	Ionization isomerism
C	$[Co(NH_3)_6][Cr(CN)_6]$	IV	Coordination isomerism
D	$[Co(H_2O)_6]Cl_3$	I	Solvate isomerism

S2. Ans.(d)

In $[Co(NH_3)_6]^{3+}$, Co^{3+} ion is having $3d^6$ configuration.

Electronic configuration of Co^{3+} :



In presence of NH_3 ligand, pairing of electrons takes place and it becomes diamagnetic complex ion.

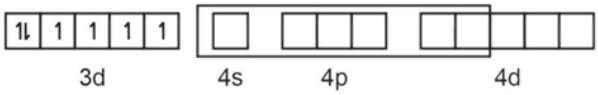
In presence of NH_3 ligand :

$\therefore$ $[Co(NH_3)_6]^{3+}$ is octahedral with d^2sp^3 hybridisation and it is diamagnetic in nature.

In case of $[CoF_6]^{3-}$, Co is in +3 oxidation state and it is having $3d^6$ configuration.

In presence of weak field F^- ligand, pairing does not take place.

In presence of F^- ligands :



$\therefore$ In $[CoF_6]^{3-}$, Co^{3+} is sp^3d^2 hybridised with four unpaired electrons, so it is paramagnetic in nature.

S3. Ans.(d)

$[Co(NH_3)_6]^{3+}$ is a homoleptic complex as only one type of ligands (NH_3) is coordinated with Co^{3+} ion. While $[Co(NH_3)_4Cl_2]^+$ is a heteroleptic complex in which Co^{3+} ion is ligated with more than one type of ligands, i.e., NH_3 and Cl^-

S4. Ans.(b)

Maximum covalency of boron is four.

S5. Ans.(c)

Complex salt is $K_2[Pt(NH_3)_2Cl_2]$

Double salt is $KAl(SO_4)_2 \cdot 12H_2O$ (ptash alum)

S6. Ans.(d)

Given complex compounds exhibit solvate isomerism having co-ordination number = 6.

S7. Ans.(d)

(1) $[Pt(NH_3)_2Cl(NO_2)]$

(2) $[Co(NH_3)_5(CO_3)]Cl$

(3) $[Cr(NH_3)_3(H_2O)_3]Cl_3$

(4) $K_3[Al(C_2O_4)_3]$

Option 4 contain all ligands are of same type i.e., why complex will be homoleptic.

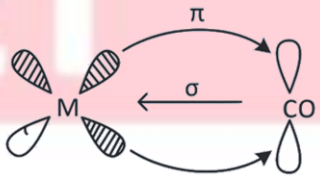
S8. Ans.(b)

Due to Chelation effect of (en).

S9. Ans.(d)

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

S10. Ans.(d)



In case of metal carbonyls, the bonding has both σ and π nature, where ligand to metal bond is 'σ' (coordinate) bond and metal to ligand bond is 'π' (synergic) bond.

S11. Ans.(d)

$[Ag(H_2O)_2][Ag(CN)_2]$

IUPAC name:

diaquasilver(I) dicyanidoargentate(I)

S12. Ans.(c)
Stronger the field strength of ligand, higher will be the energy absorbed by the complex.
$\Rightarrow$ 'en' has a stronger field strength than 'H_2O' according to spectrochemical series.
$\therefore$ Correct order of energy absorbed will be:
$[Ni(en)_3]^{2+}$ > $[Ni(H_2O)_2(en)_2]^{2+}$ > $[Ni(H_2O)_4(en)]^{2+}$
i.e., C > A > B

S13. Ans.(d)
Conceptual

S14. Ans.(c)
Conceptual

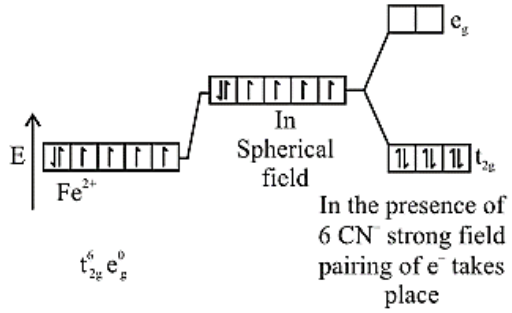
S15. Ans.(d)
Spectrochemical series the correct order of increasing field strength of ligands to form coordination compounds
$I^- < Br^- < S^{2-} < SCN^- < Cl^- < N_3^- < F^- < OH^- < C_2O_4^{2-} < H_2O < NCS^- < EDTA^{4-} < NH_3 < en < CN^- < CO$
Thus option d is correct.

S16. Ans.(a)

Hybridisation	Geometry	Coordination number
Sp^3	Tetrahedral	4
dsp^2	Square planar	4
Sp^3d	Trigonal bipyramidal	5
d^2sp^3	Octahedral	6

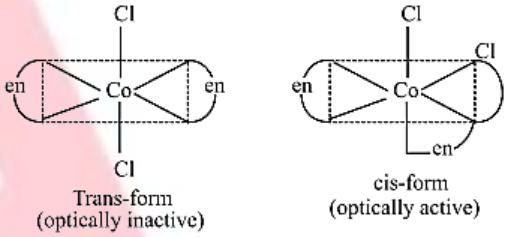
Spectrochemical

S17. Ans.(b)
$K_4[Fe(CN)_6]$
Fe ground state : $[Ar]3d^64s^2$
$Fe^{2+}: 3d^64s^0$



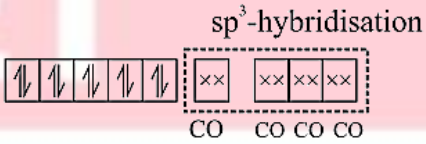
S18. Ans.(b)
Based on the number of metal atoms present in a complex, they are classified into mononuclear, dinuclear, trinuclear and so on.
Eg: $Fe(CO)_5$: mononuclear
$Co_2(CO)_8$: dinuclear
$Fe_3(CO)_{12}$: trinuclear
Hence, option (b) should be the right answer.

S19. Ans.(a)
In $[CoCl_2(en)_2]$, coordination number of Co is 6 and this compound has octahedral geometry.

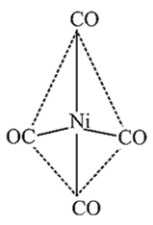


As per given option, type of isomerism is geometrical isomerism.

S20. Ans.(b)
$Ni(28): [Ar]3d^84s^2$
$\because$ Co is a strong field ligand configuration would be:



For, four 'CO'-ligands hybridization would be sp^3 and thus the complex would be diamagnetic and of tetrahedral geometry.



S21. Ans.(b)

The increasing order for the wavelengths of absorption in the visible region for the complexes of Co^{3+} is:

$[Co(en)]^{3+}, [Co(NH_3)_6]^{3+}, [Co(H_2O)_6]^{3+}$

As the spectro chemical series is:

$I^- < Br^- < SCN^- < Cl^- < S^{2-} < F^- < OH^- < C_2O_4^{2-} < H_2O < NCS^- < EDTA^{4+} < NH_3 < en < CN^- < CO.$

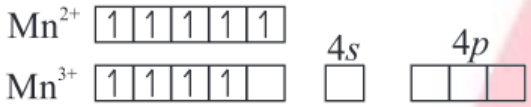
S22. Ans.(d)

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

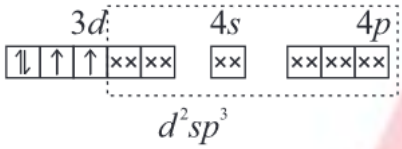
$x + 6(-1) = -3$

$x - 6 = -3$

$x = -3 + 6 \quad \Rightarrow \quad x = +3$



In presence of CN^- causes pairing



d^2sp^3

$\therefore$ d^2sp^3 is required

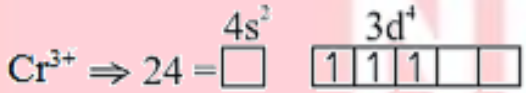
Hence, it is octahedral in shape.

S23. Ans.(d)

Complexes are respectively $[Co(NH_3)_6]Cl_3, [Co(NH_3)_5Cl]\ Cl_2$ and $[Co(NH_3)_4Cl_2]Cl$.

S24. Ans.(c)

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



$\therefore$ They have 3 unpaired electron.

$\therefore$ They are paramagnetic in nature.

S25. Ans.(c)

In $[MnBr_4]^{2-}$

$Mn^{2+} = [Ar]^{18}3d^54s^0$.

$[MnBr_4]^{2-}$ is tetrahedral complex

$n = 5$

$\mu = \sqrt{n(n+2)} = \sqrt{5(5+2)} = \sqrt{5(7)} = \sqrt{35}$

$= 5.9$

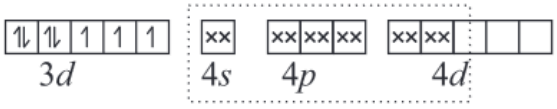
S26. Ans.(c)

$P > \Delta_0$ is a condition which favours formation of high spin complexes.

S27. Ans.(d)

$[CO(H_2O)_6]^{2+}$, N = 3 unpaired electrons.

$Co^{2+}: [Ar]3d^7$



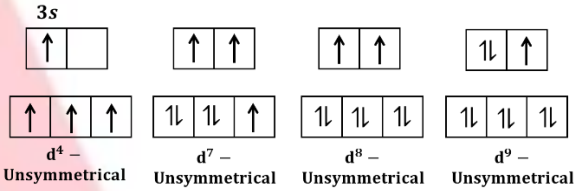
sp^3d^2

S28. Ans.(b)

The intensity of the trans-effect as measured by the increase in rate of substitution of the trans ligand follows the sequence: $CN^- > C_6H_5^- > Br^- > NH_3$

S29. Ans.(b)

Jahn – teller distortion is usually significant for asymmetrically occupied e_g orbital. In case unevenly occupied t_{2g} orbital & Jahn-teller distortion is very weak.



S30. Ans.(d)

Due to back bonding between metal carbonyl bond, length of $C - O$ increase. Also, higher the charge on central metal atom higher will be the back bonding (synergic effect).

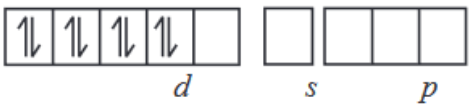
S31. Ans.(a)

Name of complex ion $[Fe(CN)_6]^{3-}$ is Hexacyaniodoferrate (III) ion

Oxidation state of Fe is +3.

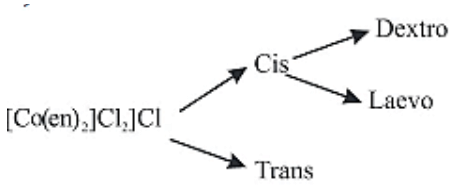
S32. Ans.(b)

Electronic configuration of $[Ni(CN)_4]^{2-}$

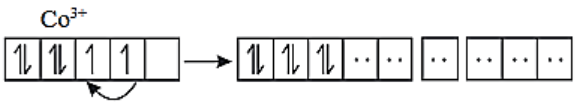


As CN^- is a strong field ligand it will form a low spin complex with dsp^2 hybridization.

S33. Ans.(d)



S34. Ans.(d)



As CN^- being a strong field ligand will form a low-spin complex.

S35. Ans.(d)

Cobalt III Chloride means that the coordinate ion number of Co^{3+} is 6, so compound must be $[Co(NH_3)Cl_3]$.

S36. Ans.(d)

$[M(en_2)(C_2O_4)]Cl$

Oxidation number of metal = 3

Coordination number of metal = 6

Sum of oxidation and coordination number

= 3 + 6

= 9

S37. Ans.(a)

In $[Fe(H_2O)_6]^{3+}$, Fe has oxidation state of +3

$d^5 = t_{2g}^3$ & e_g^2

C.F.S.E. = 0

A high spin complex is formed because H_2O is a weak field ligand.

$+0.6 \times 2 - 0.4 \times 3 = 0$

S38. Ans.(a)

Cis platin: Cis $[PtCl_2(NH_3)_2]$ is used as an anticancer agent.