GP_3368

DAILY PRACTICE PROBLEMS

CHEMISTRY SOLUTIONS

DPP/CC20

1. **(a)** $\underset{2.675\text{g}}{CoCl_3.6NH_3} \longrightarrow xCl^-$

$xCl^- + AgNO_3 \longrightarrow \underset{4.78\text{g}}{x\ AgCl\downarrow}$

Number of moles of the complex

$= \frac{2.675}{267.5} = 0.01$ moles

Number of moles of AgCl obtained

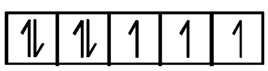
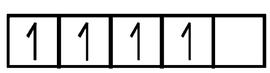
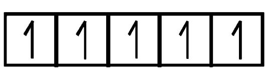
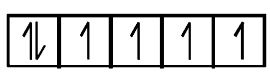
$= \frac{4.78}{143.5} = 0.03$ moles

$\therefore$ No. of moles of AgCl obtained
$= x \times$ No. of moles of complex

$\therefore x = \frac{0.03}{0.01} = 3$

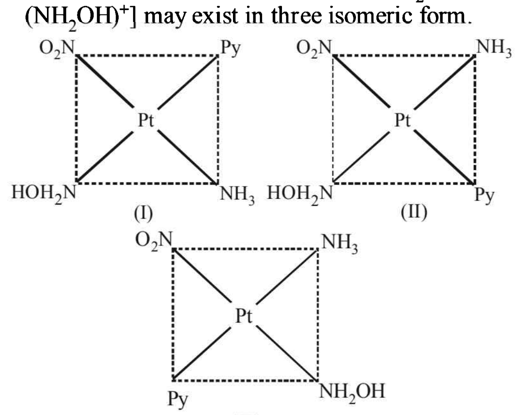
Hence, the formula of complex is $[Co(NH_3)_6]Cl_3$

2. **(a)**

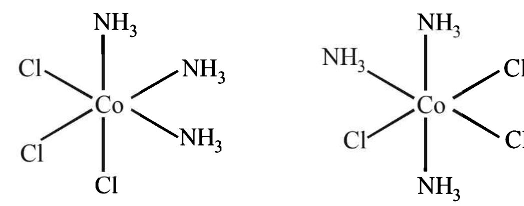
Electronic configuration			No. of unpaired electrons
Co^{2+}	d^7		3
Cr^{2+}	d^4		4
Mn^{2+}	d^5		5
Fe^{2+}	d^6		4

$\therefore$ Since Co^{2+} has lowest no. of unpaired electrons hence lowest paramagnetic behaviour is shown by $[Co(H_2O)_6]^{2+}$

3. **(b)** Complexes of the type Mabcd may exist in three isomeric form. Similarily $[Pt(NO_2)(Py)(NH_3)(NH_2OH)^+]$ may exist in three isomeric form.



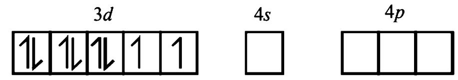
4. **(c)** Octahedral coordination entities of the type Ma_3b_3 exhibit geometrical isomerism. The compound exists both as facial and meridional isomers, both contain plane of symmetry

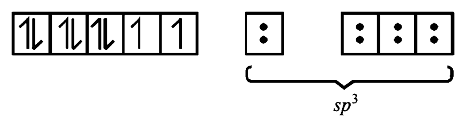


fac-　　　　mer

5. **(a)** $[NiL_4]^{2-}$

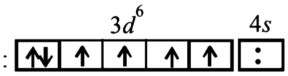
3*d*　　4*s*　　4*p*

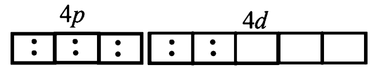
$Ni^{2+}(d^8)$ 

$[NiL_4]^{2-}$ 

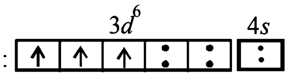
i.e, no. of unpaired electron = 2
hybridization – sp^3.

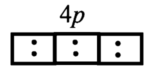
6. **(c, d)** (a) In $[Fe(C_5H_5)_2]$, EAN of $Fe = 26$, electron of $Fe + 10$ electron from two $C_5H_5^-$ ions

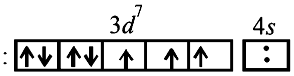
(b) $[Fe(H_2O)_6]^{2+}$: $3d^6$ $4s$ 

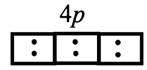
$4p$ $4d$  sp^3d^2

($\because H_2O$ a weak field ligand)

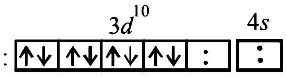
(c) $[Cr(NH_3)_6]^{3+}$: $3d^6$ $4s$ 

$4p$  d^2sp^3 (3 unpaired electrons)

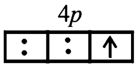
(d) $[CoI_4]^{2-}$: $3d^7$ $4s$ 

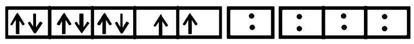
$4p$  sp^3 (tetrahedral)

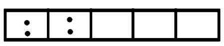
7. **(a, c)**

$[Cu(CN)_4]^{3-}$: $3d^{10}$ $4s$ 

4p

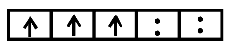
 dsp^2 hybridization

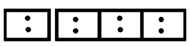
$[Ni(CN)_6]^{2-}$: 

 sp^3d^2 hybridization

$[ZnBr_4]^{2-}$:

 sp^3 hybridization

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

 d^2sp^3 hybridization

8. (b,d)

(a) $AgCl + 2NH_3 \longrightarrow [Ag(NH_3)_2]^+Cl^-$; cation is the complex ion.

(b) $FeSO_4 + 6KCN \longrightarrow K_4[Fe(CN)_6] + K_2SO_4$; anion is complex ion.

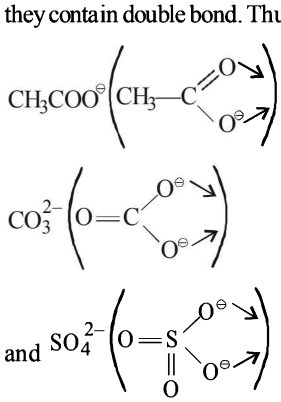
(c) $CuSO_4 + 4NH_3 \longrightarrow [Cu(NH_3)_4]SO_4$; cation is the complex ion.

(d) $PtCl_4 + 2KCl \longrightarrow K_2[PtCl_6]$; anion is the complex ion.

9. (b,c)

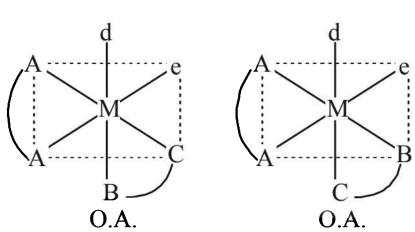
The chelates having five membered rings are more stable in the absence of double bonds in them. The chelates having six membered rings are more stable if they contain double bond. Thus (a) and (d) are incorrect.

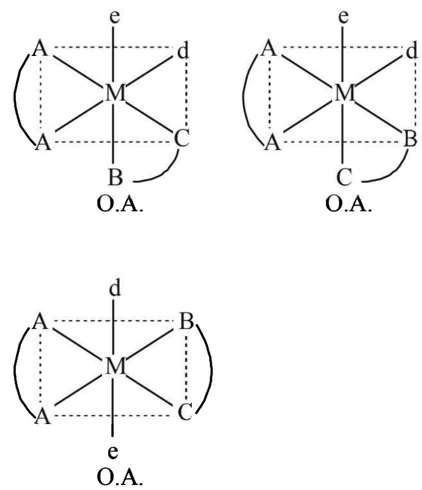
10. (3)



are negative as well as flexidentate ligand.

11. (5)





Five pairs of enantiomers are possible.

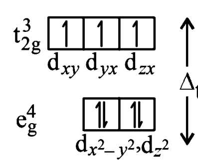
12. (2) Trans-isomer in A = 2

Trans-isomer in B = 1

$$\text{Ratio} = \frac{2}{1} = 2$$

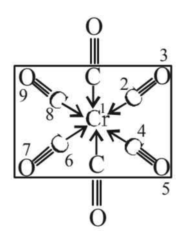
Hybridisation, VBT and CFT

13. (0) $[Co^{II}(SCN)_4]^{2-}$; $Co^{2+} = 3d^7$, C.N. = 4, TH complex.



Number of unpaired electron present in d-orbitals whose lobes are present along axis = 0.

14. (9)



9 atoms (as marked) are present in same plane.

15. (c) d^6 (high spin)

$\underline{1}\,\underline{1}$ e_g^2 CFSE $= -0.4 \times 4 + 0.6 \times 2$

$= 0.4$

$\underline{1\!\!\downarrow}\,\underline{1}\,\underline{1}$ t_{2g}^4

(n = 4)

$$\mu \text{ spin} = \sqrt{n(n+2)} \text{ B.M}$$

$$= \sqrt{4(4+2)} = \sqrt{24} = 4.90 \text{ B.M}$$

16. (d) d^3 = high spin $\quad$ μ spin $= \sqrt{n(n+2)}$ B.M

$-\,-e_g^0$ $\quad$ $\sqrt{3(3+2)}$

$\uparrow\,\uparrow\,\uparrow\; t_{2g}^3$ $\quad$ $\sqrt{15}$

(n = 3) $\quad$ = 3.87 B.M

CFSE = – 0.4 × 3

= – 1.2

17. (c) d^7 (low spin) $\uparrow\, -\, e_g^1$ CFSE = – 0.4 × 6 + 0.6 × 1

= – 1.8

$\uparrow\downarrow\,\uparrow\downarrow\,\uparrow\downarrow\; t_{2g}^6$

n = 1

μ spin $= \sqrt{n(n+2)}$ B.M

$= \sqrt{1(1+2)}$

$= \sqrt{3}$

= 1.73 B.M

18. (c) Number of moles of Na_2O added

$$= \frac{\text{Mass of } Na_2O\text{ (g)}}{\text{Molar mass}} = \frac{0.0307}{62} = 0.5 \times 10^{-3}$$

Moles of OH^- added $= 2 \times 0.5 \times 10^{-3} = 1 \times 10^{-3}$

Hence, $[OH^-]_{final} = 1.0 \times 10^{-5}$ (initial) + 1×10^{-3} (added) = $1.01 \times 10^{-3}\,molL^{-1}$

$(pOH)_{final} = -\log 1.01 \times 10^{-3} \approx 3$, $pH = 14 - 3 = 11$

According to the Fig- 1, the relative rate corresponding to pH 11 is 10 whereas for initial pH it is 5, i.e., the relative rate increases by a factor of 2.

19. (b) Molality of $[Co(NH_3)_6]Cl_3 = \frac{\text{Moles}}{\text{Mass of water (kg)}}$

$$= \frac{27/268}{\text{volume(L)}} = \frac{27}{268 \times 1} = 0.1$$

$$Co(NH_3)_6Cl_2 = \frac{23}{232 \times 1} = 0.1$$

$[Co(NH_3)_6]Cl_3(aq) \longrightarrow [Co(NH_3)_6(aq)]^{3+} + 3Cl^-(aq)$;

$[Co(NH_3)_6]Cl_2(aq) \longrightarrow [Co(NH_3)_6(aq)]^{2+} + 2Cl^-(aq)$

Hence, total molality of all the species

$= 0.1 \times (1+3) + 0.1\,(1+2) = 0.7$

20. A-r; B-s; C-p; D-q

(A) $3d^3$ (Octahedral) : d^2sp^3 hybridization; 3 unpaired elecrtons

(B) d^5 (Octahedral, low spin) : d^2sp^3 hybridization ; 1 unpaired electron

(C) d^6 (Octahedral, low spin) : d^2sp^3 ; no unpaired electron

(D) d^6 (Octahedral, outer orbital) : sp^3d^2 ; 4 unpaired electrons

Magnetic moment $\sqrt{n(n+2)}$ B.M. (n unpaired electrons)