

Chapter 7 Problems

1. Explain the magnetic moments associated with the following complexes:

- a)  $K_3[CoF_6]$ ,  $\mu_{\text{eff}} = 5.5$  B.M
- b)  $K_3[CuF_6]$ ,  $\mu_{\text{eff}} = 2.8$  B.M
- c)  $K_2[NiF_6]$ ,  $\mu_{\text{eff}} = \text{diamagnetic}$

2. Construct a Curie-Weiss plot of the following data.

T(°C)	$\chi_M$ (emu)
20	0.001994
10	0.002048
0	0.002131
-10	0.002211
-20	0.002270
-30	0.002344
-55	0.002550

and determine the nature of the intermolecular magnetic exchange if any.

3. The equilibrium constant for the reaction



is almost  $10^{35}$ , yet the hexaammine Co(III) complex will keep for weeks in an acid solution. Explain.

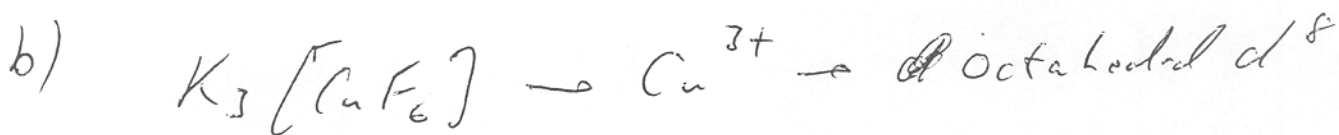
ANSWERS TO CHAPTER 7 PROBLEMS



MAGNETIC moment  $\uparrow \uparrow e_g$

CORRESPONDS TO

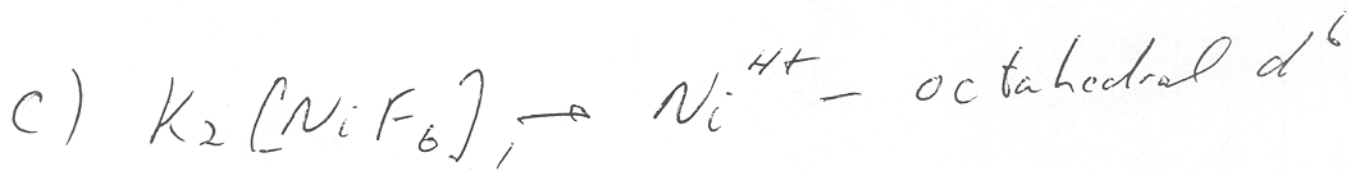
high spin case  $\uparrow \uparrow \uparrow t_{2g}$



MAGNETIC moment  $\uparrow \uparrow e_g$

CORRESPONDS TO

TWO UNPAIRED  $e^-$   $\uparrow \uparrow t_{2g}$

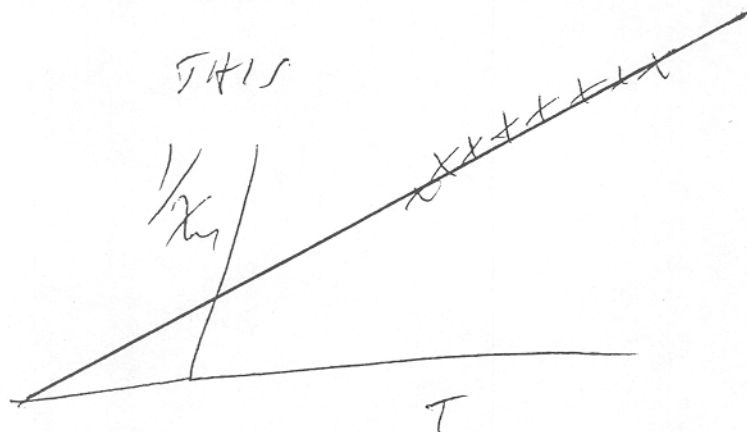


LOW SPIN  
 $d^6$  case

— —  $e_g$

$\uparrow \uparrow \uparrow t_{2g}$

2. CONSTRUCT A PLOT THAT LOOKS LIKE



- O MEANS THAT THERE IS ANTIFERROMAGNETIC INTERMOLECULAR EXCHANGE

3.  $\text{Co}(\text{NH}_3)_6^{3+}$  IS KINETICALLY INERT

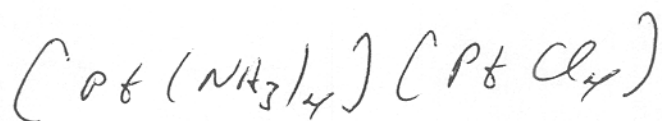
- LARGE ACTIVATION BARRIER SLOWS DOWN THE THERMODYNAMICALLY FAVOURED RXN

ANSWER TO CHAPTER 7 PROBLEMS

7.15 THERE ARE TWO COMPLEX IONS



THEY FORM THE COMPLEX SALT



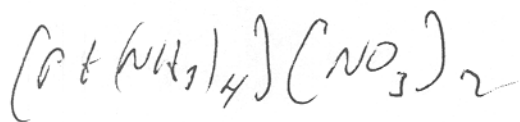
tetraammine platinum(II) tetrachloroplatinum(II)

(tetrachloroplatinate(II))

ACCORDING TO BOOK



Silver tetrachloroplatinate



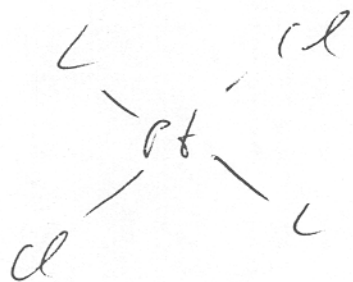
tetraammine platinum(II) NITRATE

OR

DINITRATE

7.16. ZERO DIPOLE MOMENT REQUIRES TRANS

CONFIGURATION OF LIGANDS



L =  $\text{PH}_3$  or  $\text{AsH}_3$

7.20

a)  $\text{Co}^{3+}$  ALWAYS LOW SPIN (EXCEPT  $\text{CoF}_6^{3-}$ )  $t_{2g}^6 e_g^0$ , 0, 2.4

b)  $\text{Fe}^{2+}$  h.s.,  $t_{2g}^4 e_g^2$ , 4,  $0.4 \Delta_0$

c)  $\text{Fe}^{3+}$  L.S.,  $t_{2g}^5 e_g^0$ , 1,  $2 \Delta_0$

d)  $\text{Cr}^{3+}$  PROBABLY L.S. BUT DOESN'T MATTER,  $t_{2g}^3 e_g^0$ , 3,  $1.2 \Delta_0$

e)  $\text{W}(\text{CO})_6$ , LOW SPIN,  $t_{2g}^6$ , 0,  $2.4 \Delta_0$

f)  $\text{Fe}^{2+}$ , h.s.,  ~~$t_{2g}^4$~~   $e^3 t_2^3$ , 4,  $0.6 \Delta_0$

g)  $\text{Ni}(\text{d})$ , PROBABLY L.S. BUT DOESN'T MATTER,  $e^4 t_2^6$ , 0, 0  
FOR  $d^{10}$

7.23 STRONG FIELD  
 $[\text{Co}(\text{NH}_3)_6]^{2+}$   
 YELLOW

WEAK FIELD  
 ~~$[\text{Co}(\text{NH}_3)_6]^{2+}$~~   
 $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$   
 PINK

WEAK FIELD  
 $[\text{Co}(\text{Cl})_4]^{2-}$   
 BLUE