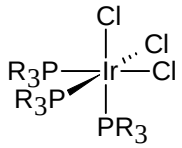
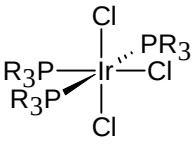
Section 1 - Solutions to Textbook Problems

Note: these three examples are mostly to get you back in the swing of things, and the solutions might be more easily found in your text or your CHEM 2351 notes.

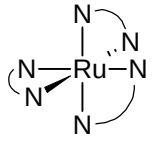
Ex. 7.14 $FeCl(H_2O)_5^{2+}$ has only 1 isomer.



fac



mer

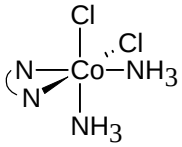


Δ

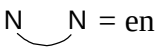


= bipy

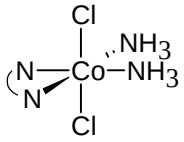
+ optical isomer Λ



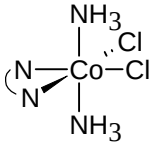
all-*cis*
(+ optical isomer)



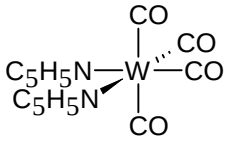
= en



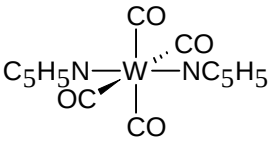
Cl *trans*



NH_3 *trans*



cis



trans

Ex. 20.1

(a) Co^{3+} is d^6, NH_3 is a strong ligand, and Table 20.1 suggests (as expected) that $Co(NH)_6^{3+}$ is low spin with $\Delta_O = 22\,900\ cm^{-1}$. Therefore, there are 0 unpaired electrons with configuration $t_{2g}^6 e_g^0$.

(b) Fe^{2+} is d^6, H_2O is a weaker ligand than NH_3, so $Fe(H_2O)_6^{2+}$ is high spin with $\Delta_O = 10\,400\ cm^{-1}$ (according to Table 20.1). Therefore, there are 4 unpaired electrons with configuration $t_{2g}^4 e_g^2$.

(c) Fe^{3+} is d^5, CN^- is a very strong ligand (and Fe^{3+} is stronger than Fe^{2+}), so we have low spin $t_{2g}^5 e_g^0$ (Table 20.1 says the $\Delta_O = 35\,000\ cm^{-1}$) with 1 unpaired electron.

(d) Cr^{3+} is d^3, so the configuration is $t_{2g}^3 e_g^0$, with 3 unpaired electrons ($\Delta_O = 21\,500\ cm^{-1}$).

(e) Everything heavier than Zn is low spin, therefore W^0 is d^6 with 0 unpaired electrons in configuration $t_{2g}^6 e_g^0$. (Note that elemental W^0 would be s^2d^4, but molecular W^0 is generally considered to be d^6).

(f) Tetrahedral are always high spin, therefore Fe^{2+} is d^6 with configuration $e^3t_2{}^3$ and 4 unpaired e^-.

(g) Molecular Ni^0 is d^{10} with configuration $e^4t_2{}^6$ and 0 unpaired e^-.

Ex. 20.5 (a) Assuming both are high spin, $Cr(OH_2)_6{}^{2+}$ must have a larger LFSE (because Mn^{2+} is d^5 with 0 LFSE).

(b) These are both d^5 so both have LFSE = 0.

(c) H_2O is weak (high spin d^5 has 0 LFSE) and CN^- is strong (therefore low spin d^5 $Fe(CN)_6{}^{3-}$ has a larger LFSE).

(d) Both low-spin d^5, but Δ_O for Ru^{3+} is stronger than for Fe^{3+}, therefore $Ru(CN)_6{}^{3-}$ has larger LFSE.

(e) Tetrahedral = high spin; Fe^{2+} is d^6 (one extra e electron) while Co^{2+} is d^7 (two extra e electrons), therefore $CoCl_4{}^{2-}$ has a larger LFSE.