

Problem set - TM complex

- Determine the no. of unpaired electrons, magnetic moment, and ligand field stabilization energy of the following complexes.  
 $[Co(CO)_4]^-$ ,  $[Cr(CN)_6]^{4-}$ ,  $[Fe(H_2O)_6]^{3+}$ ,  $[Co(NO_2)_6]^{4-}$   
 $[Co(NH_3)_6]^{3+}$ ,  $MnO_4^-$ ,  $[Cu(H_2O)_6]^{2+}$
- Predict the magnetic moment (spin only) of the following species  
 $[Cr(H_2O)_6]^{2+}$ ,  $[Cr(CN)_6]^{4-}$ ,  $[FeCl_4]^-$ ,  $[Fe(CN)_6]^{3-}$ ,  $[Ni(H_2O)_6]^{2+}$   
 $[Cu(en)_2(H_2O)_2]^{2+}$
- What are the possible magnetic moments of Co(II) in tetrahedral, octahedral and square planar complexes?
- Identify the most likely transition metal M from the following condition
  - $K_3[M(CN)_6]$ , M is 1<sup>st</sup> row transition metal & the complex has three unpaired electrons.
  - $[M(H_2O)_6]^{3+}$ , M is a 2<sup>nd</sup> row TM, with  $LFSE = -2.44\Delta_0$ .
- Of the first-row TM complexes of formula  $[M(NH_3)_6]^{3+}$ , which metals are predicted by J-T theorem to have distorted complexes?
- An aqueous solution of  $Ni(NO_3)_2$  is green. Addition of aqueous  $NH_3$  causes the color of the solution to change to blue. If ethylenediamine is added to green solution, the color changes to violet. Account for the colors of these complexes. Are these consistent with the expected positions of these ligands in the spectrochemical series?
- Suggest why  $TiO_4^-$  is red.  $MnO_4^-$  is purple.