1. Use the pictures of the d orbitals above to answer the following:

a. Which orbitals have the lowest energy in an octahedral complex and why?

b. A complex ion has a square planar geometry oriented in the xy plane with ligands on the x and y axes. According to crystal field theory, which orbital would you expect to have the SECOND highest energy for this square planar complex?

2. How many unpaired electrons are in the following? (draw the d orbital diagrams)

a. [Fe(CN)₆]³⁻

b. [Ni(en)₃]²⁺

c. [VCl₄]²⁻ (tetrahedral geometry)
3. Match the compounds with the wavelengths they absorb: 420 nm, 500 nm, 650 nm

   a. [Co(NH$_3$)$_6$]$^{3+}$

   b. [Co(NO$_2$)$_6$]$^{3-}$

   c. [CoF$_6$]$^{3-}$

4. Predict the color that the above compounds would appear:

   a. [Co(NH$_3$)$_6$]$^{3+}$

   b. [Co(NO$_2$)$_6$]$^{3-}$

   c. [CoF$_6$]$^{3-}$

5. A solution of the complex ion [Zn(H$_2$O)$_6$]$^{2+}$ is colorless whereas [Ni(H$_2$O)$_6$]$^{2+}$ is green. Why?

6. A crystal that contains a complex ion is known to absorb light with energy of 252 kJ/mol. Determine the color of the crystal.