HW 9
CHEM 362

Due: November 19, 2019

1. For each of the following a) determine the ground state term symbol and b) determine the state symbol(s) if split y an octahedral field

   a. d^1
   b. d^6
   c. d^7
   d. d^8

2. Describe the two selection rules for electronic transitions. Be sure to explain *why* they arise or exist

3. Rank the following transitions by their absorbance intensity and give an expected molar absorptivity range for those abosrbances:

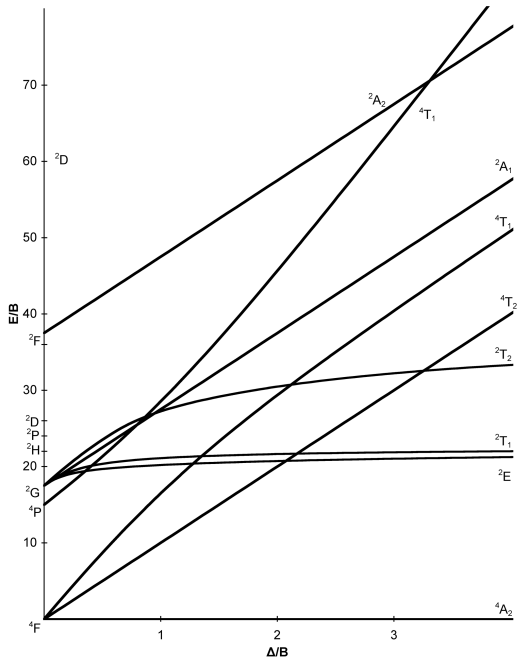
   $^3A_{1g} \rightarrow {}^3T_{2g}$
   $E_g \rightarrow E_u$ (ie. MLCT)
   $^1T_{1g} \rightarrow {}^3T_{2g}$

4. Why are d-d transitions from tetrahedral complexes stronger than octahedral complexes?

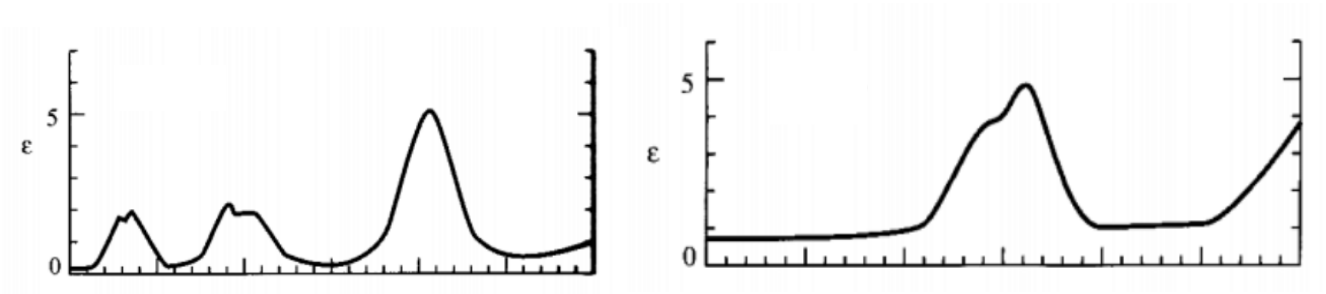
5. The compounds TiO_2 and ZnO appear as white powders. Explain this phenomenon. *Hint: consider the electron configuration of the metal*

6. Consider the Tanabe-Sugano diagram for a d^3 metal in an octahedral field.

   a. From the ground state, which transitions would you expect to see in an absorbance spectrum?
   b. The spectra of $[Cr(NH_3)_6]^{3+}$ shows two ligand field transitions at 21 550 cm^{-1} and 28 500 cm^{-1}. Which transition is which?



7. Consider the UV-vis spectra shown below. One is from an aqueous solution of $[Ni(H_2O)_6]^{2+}$, and the other is from an aqueous solution of $[Ti(H_2O)_6]^{3+}$. Which spectrum belongs to which complex, and why? *Hint: Determine the ground state term symbol for each complex. Consider the Tanabe-Sugano diagram(s) for the respective electron configurations. What are the spin allowed transitions?*



8. What is the Jahn-Teller theorem? How does it affect the geometry of an octahedral coordination complex?

9. List 4 differences between diamond and graphite. Explain these differences based on structural and bonding arguments.

10. Draw the band structure of a) a conductor or metal b) a semiconductor c) an insulator