

Chem 155 Homework #9 Due at the start of class on **Mon. Mar. 10**

Reading: Chapter 6, begin Chapter 20 (yes, back to 20!)

Note 1: It is easy to be overwhelmed by chapter 20. I recommend reading the homework problems FIRST, then reading the chapter to focus on the sections needed to answer the homework (and those covered in lecture).

Note 2: You'll hopefully find this homework easier than average. This is your hint to start your lab 5 write up before Monday night.

Chapter 6 Problems:

6.8

6.9

6.17

6.20

6.28

6.33

Chapter 20 Problems:

20.31

20.35

20.39

Additional Problems:

- 1) Discuss the experimental evidence supporting the existence of molecular orbitals. Explain how a chemist might measure the energy of an electron in a particular molecular orbital.
- 2) When we breath in air, O_2 is taken up in the blood by the protein hemoglobin, which contains Fe^{2+} ions bound to a heme group [(heme) Fe^{2+}]. The iron-heme reversibly binds O_2 , picking it up and releasing it in the other tissues (see Oxtoby, pp. 284-286). In the bound form (oxygenated heme), one electron is transferred from the iron to the O_2 so that this species can be described as [(heme) $Fe^{3+}(O_2^-)$]. Is the oxygen-oxygen bond length in heme longer or shorter than the bond in O_2 . Explain.
- 3) Find a paper with a molecular orbital measurement that shows an experimental measurement of a molecular wavefunction (e.g. via STM, angle resolved UPS, or otherwise). Include a printout on your homework and the citation.
- 4) Draw, and label the hybridization, and bond angles of each carbon atom in:
 - a) toluene
 - b) butane
 - c) acetic acid
 - d) methyl cyanate