

Chem 155 Homework #9 Due at the start of class on **Mon. Mar. 11**

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

Note 1: It is easy to be overwhelmed by chapter 20. I'd suggest 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