

### CCB 421/521: Homework 6

Due in class on Thursday, April 14. (Note: these are problems from the book; I'm posting them here because the electronic/Kindle version of the text seems to have lots of typos. Let's hope I don't make typos myself!)

**A6-1** Show by construction of a group multiplication table that the  $\text{H}_2\text{O}$  molecule has the four symmetry elements  $E$ ,  $C_2$ ,  $\sigma_{yz}$ ,  $\sigma_{xz}$ . Why are  $C_2^+$  and  $C_2^-$  not needed? Note: Use the  $yz$  plane for the molecule with the  $z$  axis bisecting the molecule.

**A6-3** Find all the elements of symmetry of ethane in both the staggered and eclipsed conformations.

**A6-4** Use Eq. (A6-12) and Table A6-1 to demonstrate that  $\sigma_1$ ,  $\sigma_2$ , and  $\sigma_3$  belong to the same class in the  $C_{3v}$  point group.

**A6-5** Only do this part: Determine the point groups of the uppercase letters of the alphabet.