Massachusetts Institute of Technology
Organic Chemistry 5.512

February 28, 2005
Prof. Rick L. Danheiser

Problem Set 1
Review of Stereochemical Principles

1. Define "stereogenic center". What is the difference between a chiral center and a stereogenic center?

2. Define the terms "stereoselective reaction" and "stereospecific reaction" and give an example of each.

3. Define the terms "diastereotopic face" and "enantiotopic face" and give an example of each.

4. Why is the following title nonsensical: "A Chiral Total Synthesis of Strychnine"?

5. Define "allylic strain". Give an example of a molecule with $A^{1,2}$ strain and a molecule with $A^{1,3}$ strain.

6. Why will we discuss the products of reactions in terms of "enantiomeric purity" rather than "optical purity" in 5.512?

7. Define "kinetic resolution".

8. Define "antiperiplanar" and "synclinal" and illustrate each using both Newman projections and sawhorse representations for *n*-butane.

9. Define "prochiral faces" and illustrate with an example.

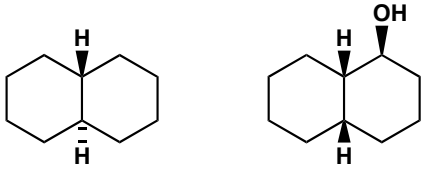
10. What is the barrier to rotation (in kcal/mol) about the carbon-carbon bond in ethane?

11. Draw the *s-trans* and *s-cis* conformations of acrolein. Which is lower in energy?

12. Rank the following substituents in terms of conformational free energies on cyclohexane rings: CH_3, OH, CN, OMe, ethynyl, *i*-Pr, CHO, Br, CO_2Et, H.

13. Define "anomeric effect" and provide an example.

14. Draw an artistic and accurate three-dimensional representation of *trans* decalin and the two alternative conformers of the hydroxy *cis*-decalin shown below.



15. Draw the cis and trans conformational isomers of methyl acetate. Which is lower in energy? By roughly how much?