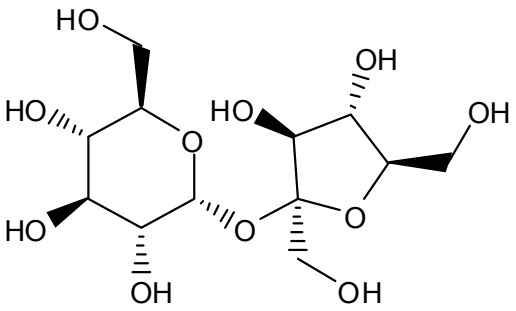
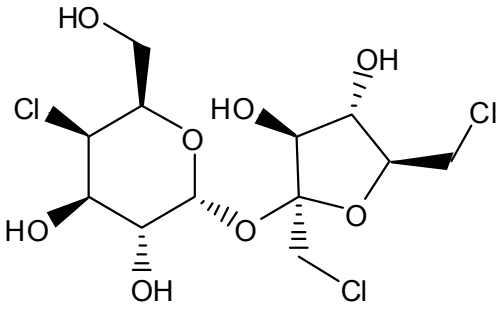
Chemistry 2301

Workshop 8
Cyclohexane Conformers, and Sweetness

Sucralose (marketed as Splenda by Tate & Lyle) is a chlorinated sugar that mimics the three-dimensional structure of sucrose, and tastes even sweeter than sucrose. The chlorines prevent sucralose from being metabolized by the body, making it a no-calorie sucrose substitute.



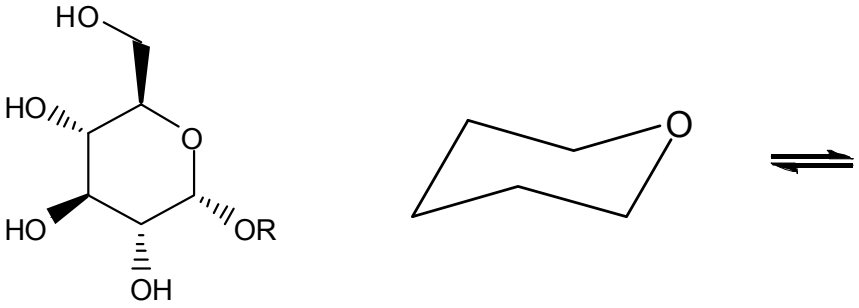
sucrose



sucralose

This workshop addresses the three-dimensional structures and preferred conformations of each of these two molecules. We'll be considering the conformations of the six-membered and five-membered rings separately, and then we'll put the rings together to look at the whole molecule.

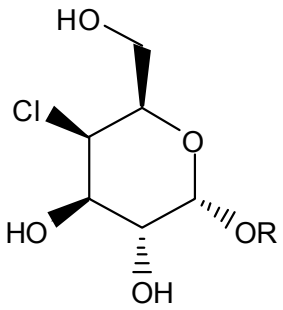
a) Starting with sucrose: One of the two possible chair conformers of sucrose's six-membered ring is shown below. Draw the other chair conformer (by "flipping" the chair), and then add the ring substituents in their appropriate axial and equatorial positions.



sucrose

b) Which of these conformations do you think is more stable?

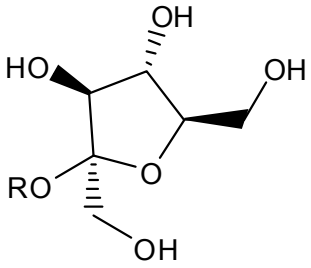
c) Now draw two chair conformers for sucralose. How is sucralose similar to/different from sucrose?



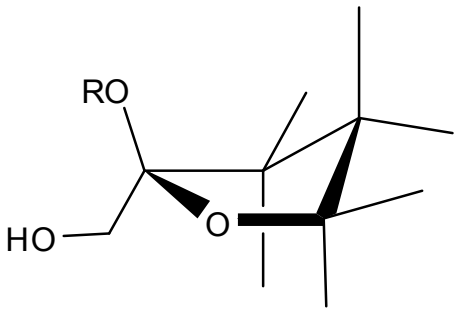
sucralose

d) We discussed in class that cyclopentane rings are like envelopes, with a flat side and a "flap" side. In a way, the flap is like the head or foot of a cyclohexane chair, in that it can go up or down. Just as in cyclohexane, the flap also has "axial-like" and "equatorial-like" substituents.

I've drawn the framework of one of the two cyclopentane conformers of sucrose below. Fill in the appropriate substituents, and consider which are "axial-like" and which are "equatorial-like". Then, flip the flap, and draw the other cyclopentane conformer of sucrose. Which would be more stable?



sucrose



e) How would sucralose's five-membered ring compare to this?