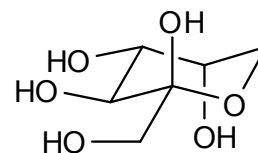


Chemistry 2302

Workshop 12 Sugars as Hemiketals

In water, fructose equilibrates between a six-membered ring hemiketal (shown at right) and an acyclic, ketone form.



fructose
(β -D-pyranose
form)

1. What is a hemiketal? Find the hemiketal group in the molecule on the right.
2. In the space below, draw an acid-catalyzed mechanism that shows how the hemiketal converts to a ketone. (It might help to first identify the C-O bond in the hemiketal that will become the C=O bond in the ketone.)

3. These two forms also equilibrate with a five-membered ring hemiketal. (This is the preferred form of fructose when it is part of a complex sugar like sucrose.) On the next page, draw the structure of this five-membered ring isomer, and an acid-catalyzed mechanism for its formation.

4. In class, you learned that the stability of acetals and ketals depends upon entropy. Of the three species you considered in this problem—5-membered ketal, 6-membered ketal, and acyclic ketone—which would be entropically favored?