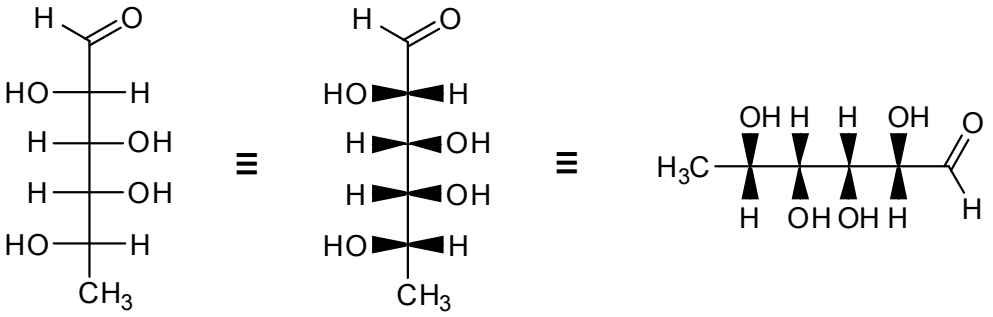
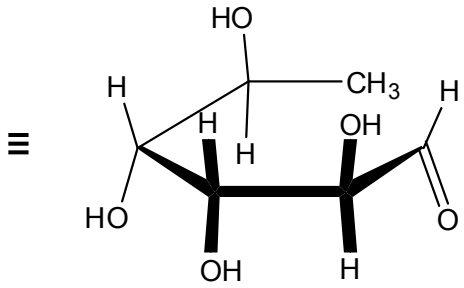
Chemistry 2302

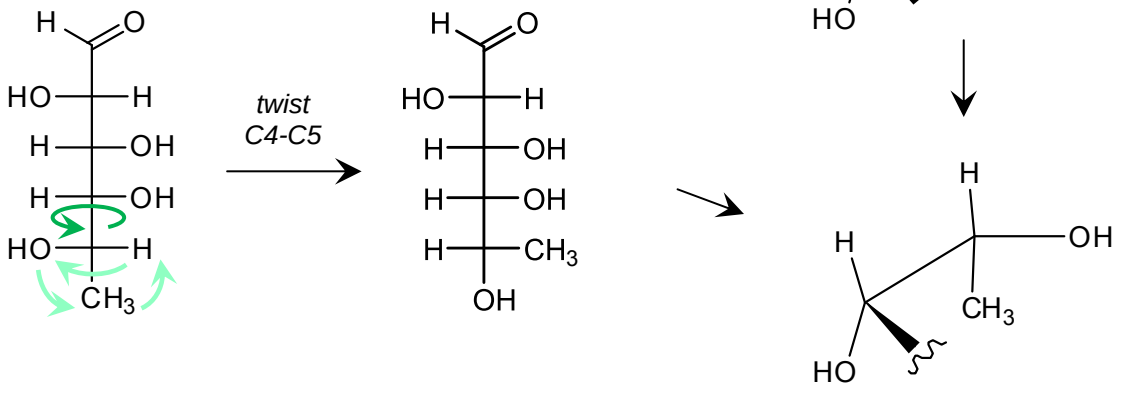
In-Class Exercise Solutions
Drawing Cyclic Monosaccharides

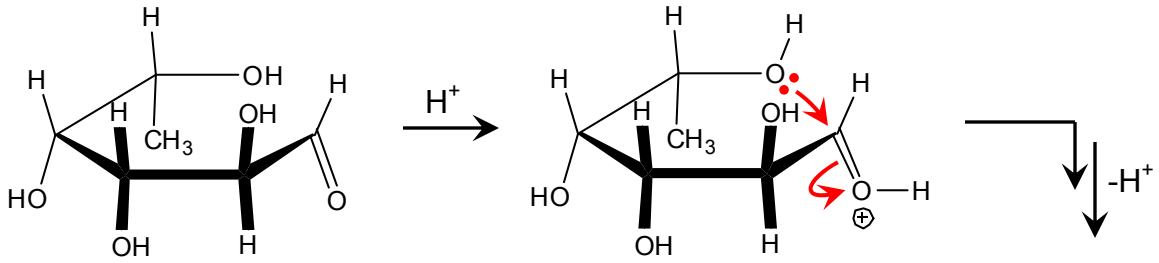
The Fischer projection is the same as a wedge/dash structure in which all of the left- and right-hand substituents are towards you. If we rotate that wedged structure 90° clockwise, we can put it into the position we need to create a cyclic structure.



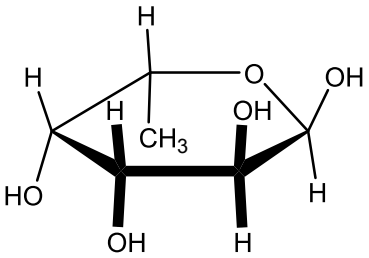
I got to this last structure on the right by curling the left-hand side of the molecule behind the right side. That puts a methyl group adjacent to the aldehyde, but to make a cyclic hemiacetal, I need an alcohol group next to the aldehyde. I can fix this by rotating the C4-C5 bond. The result is a structure that can now cyclize to form a hemiacetal (shown on the next page). Alternately, I could have done the C4-C5 twisting before I curled the molecule, by making sure that the aldehyde and the -OH adding to the aldehyde are in a straight line:



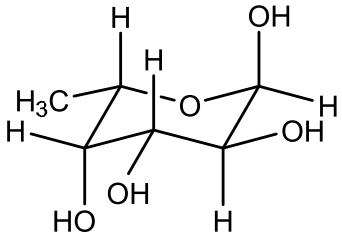




These are all shown as Haworth (flat) rings, but if we draw the molecule on the right as a chair, we get

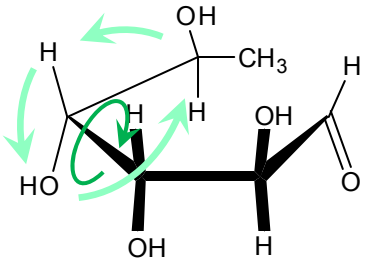


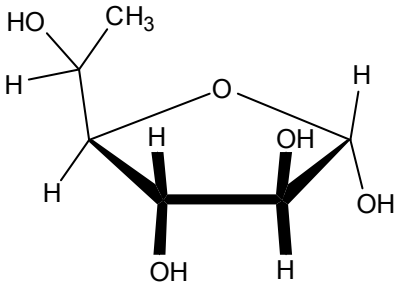
6-membered ring (pyranose)
Haworth structure of of L-fucose



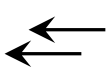
6-membered L-fucose,
in its chair conformer. (In this case, the α-anomer, with the -OH opposite C6.)

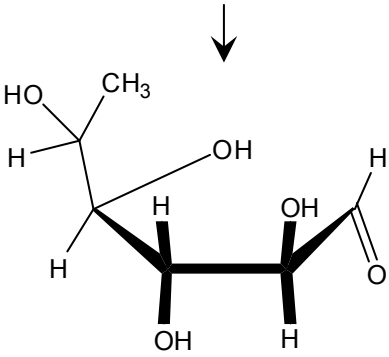
We can also draw the original ribbon Fischer projection in a five-membered ring-like form:





5-membered α-L-fucose,
as a Haworth projection.





The 5-membered ring takes on an envelope conformation. The problem stated that the anomeric effect predominates here, and that means that the C1 -OH group needs to be axial: