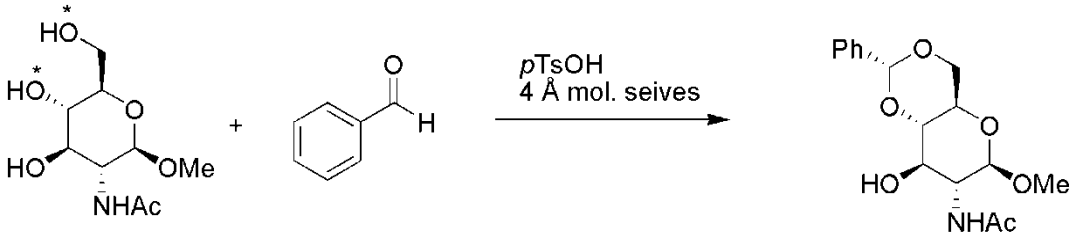
Name (Print)_____

ID#_____

Group #_____

PS #7 - Orbitals and Conformations: Sugars and the Anomeric Effect

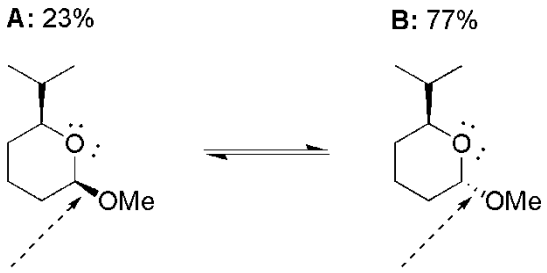
Part A) Recall that aldehydes can be protected by reaction with diols to form cyclic acetals. Using similar reactivity, certain diols can be protected by reaction with aldehydes. The reaction below is a powerful protection method that leads to the selective protection of two alcohols marked with a * by a single equivalent of benzaldehyde. As a group, propose a detailed mechanism for formation of the cyclic acetal.



Part B) Draw the product in a full 3-D representation. *Politely ridicule each other's chairs until all are perfect representations of the molecule's shape.*

Part C) There is another acetal product that could be formed in the above reaction. The two vicinal alcohols could have reacted with benzaldehyde resulting in the formation of a five-membered ring. This would be the product predicted by Baldwin's rules for the rates of ring closing reactions. Obviously rates don't matter here… how is it that the 6-membered ring is the observed product?

Part D) The sugar-like compound below can actually equilibrate between the two diastereomers shown (the mechanism involves acetal hydrolysis and re-formation, but it is unimportant for this question). The isomer at right (**B**) is favoured. *The origin of this effect commonly observed for sugar-like saturated heterocycles lies in a consideration of orbital alignment.*



What kind of hybrid orbitals are the ring oxygen's lone pairs occupying? Draw the compounds in realistic 3-D representations that includes the geometries of the lone pairs.

Now do the same for the σ* antibonding orbitals of the bonds indicated by arrows.

Why is **B** more stable than **A**? Use pictures and a brief note to explain.