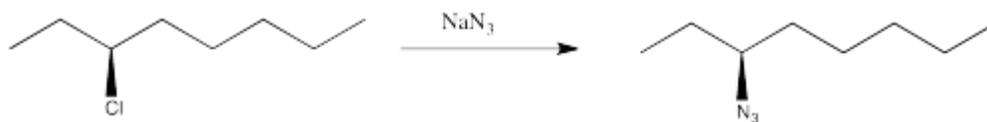


STEREOCHEMISTRY

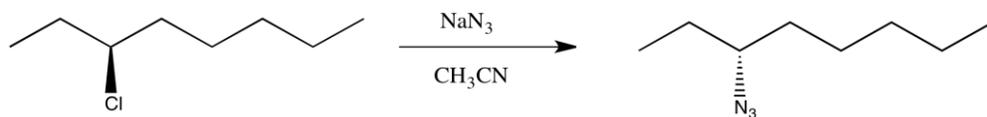
Apart from measuring rates of reaction and deducing the rate law, there are other lines of evidence that can suggest how the reaction is occurring. For aliphatic nucleophilic substitution, stereochemistry of the products provides some additional evidence.

Suppose you carry out a nucleophilic substitution reaction using a chiral starting material. You decide to convert (*S*)-3-chlorooctane into the corresponding azide. Azides are pretty widely used reagents (but slightly dangerous and potentially explosive). They are employed in a class of reactions called "click chemistry"; you've just heard about these reactions and you want to try one out for yourself.



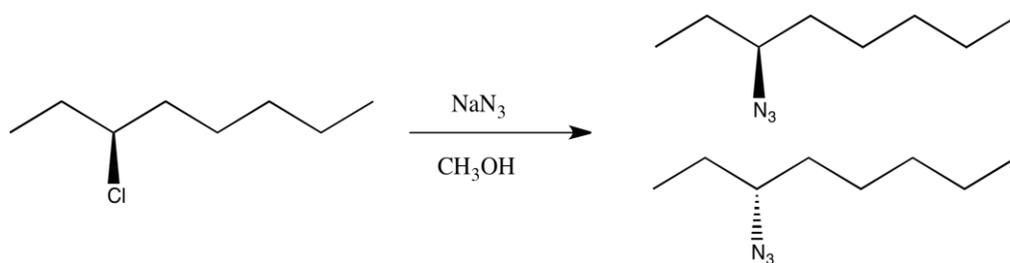
You have complete control over the mechanism of the reaction (not so easy in reality, but in this thought experiment you can set the dial on your stir plate to the desired mechanism). You choose to make the reaction occur through an S_N2 pathway.

You know the product will be chiral, so you plan to check its optical rotation. The trouble is, once you have finished the reaction, the optical rotation is exactly the opposite of what you were expecting, based on the values of other compounds like this one. You did the reaction successfully but got the unexpected enantiomer.



You're not worried. You've been taking this nifty chemistry class and you have an idea of something else to try. This time you select an S_N1 pathway.

You finish the reaction and get the right product, but it shows no optical rotation whatsoever. This time you got a racemic mixture.



This is just a thought experiment, but what would it all mean? Why might changing mechanism influence the stereochemistry?

This is just a thought experiment, but the results are generally true: in an $\text{S}_{\text{N}}2$ reaction, the chiral center undergoes an inversion. The three-dimensional arrangement of groups around the chiral center is the opposite of how it started. In an $\text{S}_{\text{N}}1$ reaction, the chiral center undergoes racemization. There is a 50:50 mixture of enantiomers.

Source: <http://employees.csbsju.edu/cschaller/Reactivity/nusub/NSstereochem.htm>