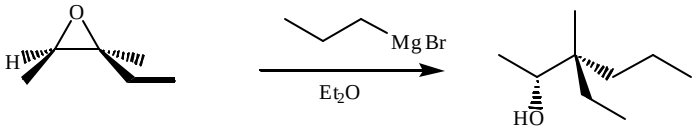
Whittier College

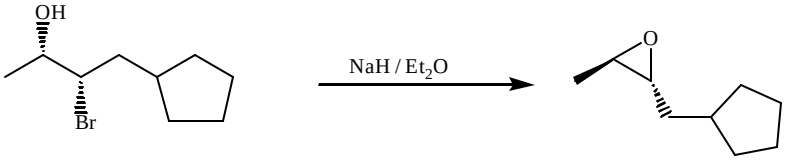
Organic Chemistry: CHEM 231A
Practice Problem Set #5

1. Predict whether the following reactions will occur as drawn. Propose a proper product for the reaction if it does not occur as drawn. Explain your rationale:

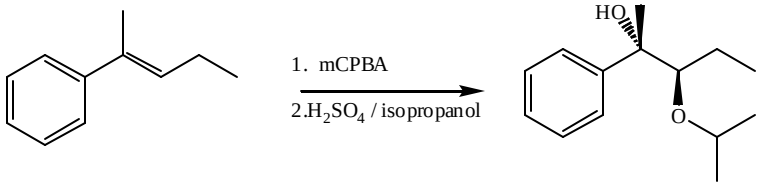
1a.



1b.



1c.



2. The reaction of (2R) 2-phenyl-2-bromopropane in aqueous ethanol at 50 C gives a mixture of products. When the experiment is repeated in the presence of 0.01M LiCl, some 2-chloro-2-phenyl propane is formed. In subsequent reactions, as the concentration of LiCl is increased, more and more 2-chloro-2-phenyl propane is formed at the expense of the other products. Throughout this series of experiments, the rate of disappearance of (2R) 2-phenyl-2-bromopropane, -d[RBr]/dt, is unchanged.

2a. What products are formed before the addition of LiCl?

2b. What is the optical rotation of the entire mixture of products? Explain briefly.

2c. How can the products change when the rate does not change?

2d. Draw a mechanism or several mechanisms that explain these results.

3. If (4R) 4-isopropyl-1-methyl-1-cyclohexene is reacted with meta-chloro perbenzoic acid (mCPBA), two compounds are observed via GC-MS, both having a mass spectrum with the highest mass peak at 154 m/z and very similar NMR (Compounds A & B). If the resultant mixture of compounds A & B are reacted ethyl magnesium bromide followed by aqueous workup, two new compounds are observed via GC-MS, both having a mass spectrum with the highest mass peak at 184 m/z and both have very similar NMR (compounds C & D). The resultant mixture of compounds C & D are reacted with trifluoromethyl sulfonyl chloride and pyridine, two new compounds are formed, compound E &F. These two compounds were separated using chromatography and characterized. Both had very similar NMR and Mass Spectra (highest mass = 284 m/z). When each compound is reacted with t-butoxide, a new product is formed, Compound G & H, respectively. Each are very similar by NMR and GC-MS (highest mass = 166 m/z). However, it is noted that compound E reacts substantially slower than compound F.

3a. What are the identities of each product (A – H)?

3b. Why is there a different rate for the reaction of E & F? Use mechanisms, transition states and energy diagrams to help explain your answer.

3c. What is the optical purity of each product (A – H)? Explain briefly.