

CHM 2210 - Ch 11 Homework

1. Discuss the substrates, nucleophiles, solvents, and leaving groups which optimize the S_N2 and S_N1 reactions. Include a diagram of an optimal S_N2 reaction. (4 pts)

2. Discuss the substrate (including geometry) and solvent conditions which optimize E2 and E1 reactions. (2 pts)

3. (R)-3-hexanol slowly becomes racemized to both (R) and (S) when mixed with dilute H_2SO_4 . The reaction is $\text{S}_{\text{N}}1$ at low H_2SO_4 concentration, and is similar to steps 2 and 3 in McMurry, Figure 11-8. After the first step, where the alcohol O is protonated (with H^{+1}), water becomes the leaving group (LG), and is the incoming Nu as well. The carbocation is planar with a top and a bottom, which results in a pair of enantiomers as products. Show this entire process in 3D. Include both products. Explain why this reaction is optimal for $\text{S}_{\text{N}}1$. (1 pt)

4. (R)-3-hexanol is converted to two different hexenes at higher H_2SO_4 concentrations. In this case, all of the water has been converted to H_3O^{+1} , so that is not available as a Nu. Instead, HSO_4^{-1} functions as a base to remove an H^{+1} from the carbocation, similar to the E1 reactions in the class notes and in Figure 17-6 of McMurry. Show what happens to the carbocation. Include both alkene products. Explain why this reaction is optimal for E1. (1 pt)

5. Review E2 reactions in the class notes, and review example 11-5a at the end of chapter 11 in McMurry. Also, review the tertiary alkyl halides bullet immediately preceding that example. Diagram the reaction between 3-methyl-3-bromopentane (a 3° alkyl halide) and CH₃ONa (methoxysodium, a strong base). Explain why this reaction is optimal for E2. (1 pt)

6. Review example 11-5b at the end of chapter 11 in McMurry. Diagram the two reactions between 3-methyl-3-bromopentane and CH₃OH (methanol, a polar protic solvent), which create two different products. The S_N1 product will be an ether (R-O-R'), similar to the reaction at the end of section 11-5 (The Solvent) in McMurry, except that the incoming Nu is CH₃OH (not water). Explain why this reaction is optimal for both S_N1 and E1. (1 pt)