

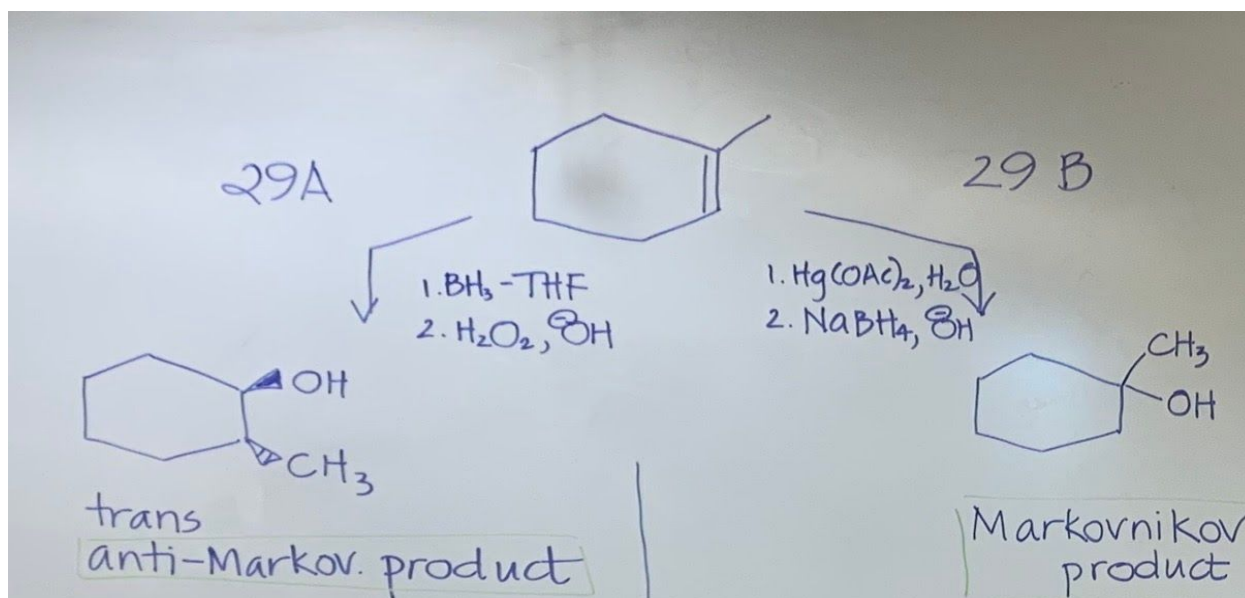
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340-L R

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Exp 29: Markovnikov and Anti-Markovnikov Hydration of 1-Methylcyclohexene

Introduction:



As seen in the image above there were two outcomes that were possible for this lab. There was an anti-Markovnikov product and a Markovnikov product, the former product was formed in section A while the latter product was formed in section B. The process of hydroboration is used in section A while looking for the anti-Markovnikov product. The method of hydroboration includes the use of two hypodermic syringes through the septum, one is used to control the pressure within the round bottom flask by means of aeration and the second is used to insert the 3.0mL of borane-tetrahydrofuran slowly. The process of oxymercuration is used in

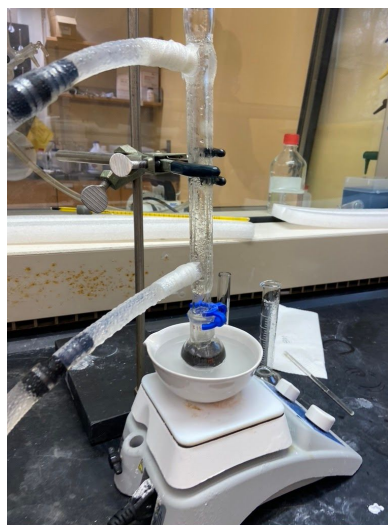
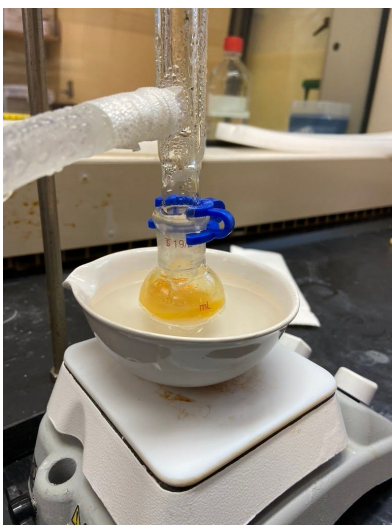
section B while looking for the Markovnikov product. The method of oxymercuration includes the use of mercury. It should be noted that the process of oxymercuration requires an immense amount of concentration and preparedness in order to successfully run this process. While using the gas chromatography to analyze the samples made from sections A and B the machine will be looking for relative percentages of Markovnikov and anti-Markovnikov products. The results found will help in determining if the products that were found in both of the samples were pure and if not what other materials were present within the samples.

Purpose:

The overall purpose of this experiment is to synthesize the Markovnikov and Anti-Markovnikov products through the processes of oxymercuration, hydroboration, and oxidation.

Methods:

The protocol for this lab was followed by the textbook "A Microscale Approach to Organic Laboratory Techniques" (Fifth Edition) by D. Pavia, G. Lampman, G. Kriz, and R. Engel. The changes to the lab were the use of screwed topped test tubes in place of the centrifuge tubes. As well as a change to the stirring time in part B after added the sodium borohydride there is no need to wait the full 30 minutes if you see the change in color to black/dark color. The percent yield was not calculated for 29B. On the next page, you can see the change in color after the addition of sodium borohydride.



Results:

The ratio from the GC for part A: .22 to .061 (mark to non-mark)

The ratio from the GC for part B: 100 to 0 (mark to non-mark)

Discussion and Conclusion:

In this lab, it was found by using the gas chromatography that both a Markovnikov and an anti-Markovnikov product were found in their respective samples (the sections which produced these products are specified within the introduction). This means that the hydroboration and the oxymercuration were both successful in the hydration of 1-methylcyclohexene. The results of this lab did, however, show some starting material left in both of the samples which is to be expected and did not alter the findings of the products. The data that was found from section A's sample shows that there is a ratio of 0.22 Markovnikov to 0.061 anti-Markovnikov. This data shows that while the correct product was synthesized there still was some Markovnikov product that was detected. The data that was found from section

B's samples shows that there is 100% of Markovnikov product in the sample with no detectable anti-Markovnikov product.