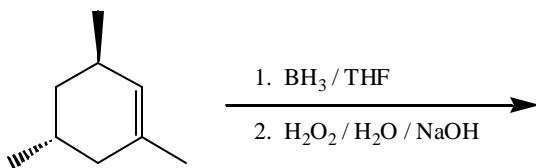




2. Given the following reaction: (30 Points)



2a. What is the name of the starting material?

2b. What type of reaction is occurring?

2c. What is (are) the transition state(s) for the addition of borane to the alkene? If there is more than one Transition State, circle the most stable Transition State and explain your rationale.

2e. What products are formed in the overall reaction?

2f. Draw two (2) of the products in their most stable conformation. Briefly explain why each of these are the most stable conformations.

2g. Which product would you expect to be the major product? Explain.

3. When achiral 3,6-dimethyl-4-octyne is first reacted with mercury acetate in water followed with treatment with sodium borohydride and sodium hydroxide in water, one product is observed by NMR. (20 points)
- 3a. Draw the reaction that is occurring. That is, what is the starting material and what are the reagents?
- 3b. What kind of reaction is occurring?
- 3c. What is the mechanism for the reaction?
- 3d. What product(s) is (are) formed? If you predict more than one product, why is only one observed by NMR?
- 3e. What is the name of one of the products?

4. Consider the following reaction: (30 points)

When optically pure (3S) 3,4-dimethyl-1-pentene is dissolved into methanol and one drop of hydrochloric acid is added, a reaction occurs in which three (3) products are observed by NMR and TLC: two molecules, which could each be described by NMR as 2-methoxy-3,4-dimethylpentane, and another molecule that could only be described as 3-methoxy-3,4-dimethylpentane.

4a. What does it mean that a compound is optically pure? How does that affect this problem?

4b. Draw the reaction that is occurring.

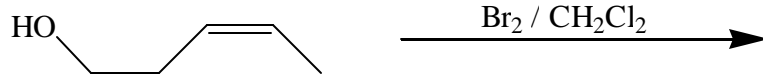
4c. Draw a mechanism or mechanisms that account(s) for the formation of the observed products.

4d. Draw the structures of the products that are formed, based on your mechanism.

4e. What is the optical purity for each product? Explain. If you predict an optical purity, why can NMR not tell you the configuration?

- 4f. Based upon one of your mechanisms, draw an energy diagram that describes the formation for one (1) of the observed products. Ensure that you label all of the appropriate energies and parts of the diagram.

Extra Credit: Given the following reaction: (15 points)



a. What is a mechanism for the reaction?

b. What are the products for the reaction? If there is a major product, circle and explain.