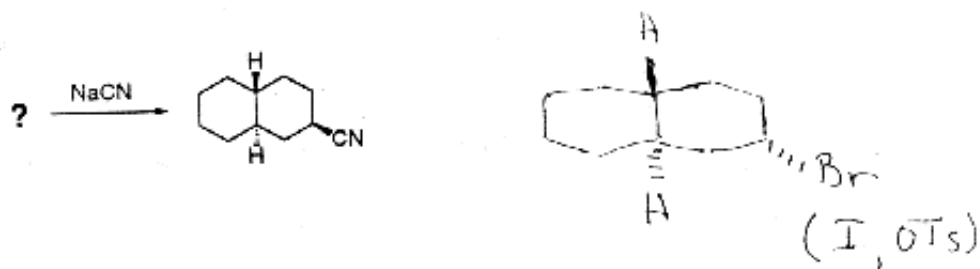
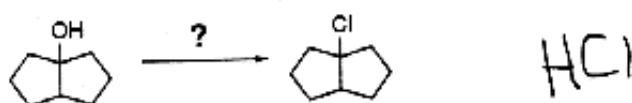


- I. (15 points) Provide the missing starting materials, reagents, or products for the following reactions. If more than one product will result, show both the major and minor products. Carefully show the stereochemistry of each product if pertinent.

A.



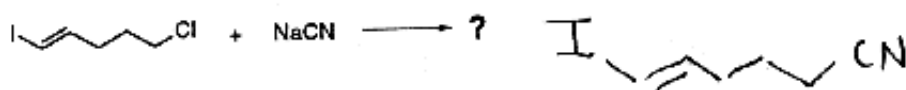
B.



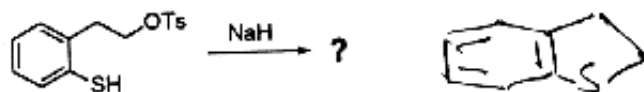
C.



D.

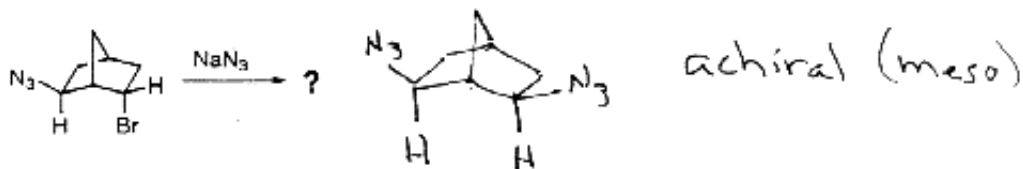


E.

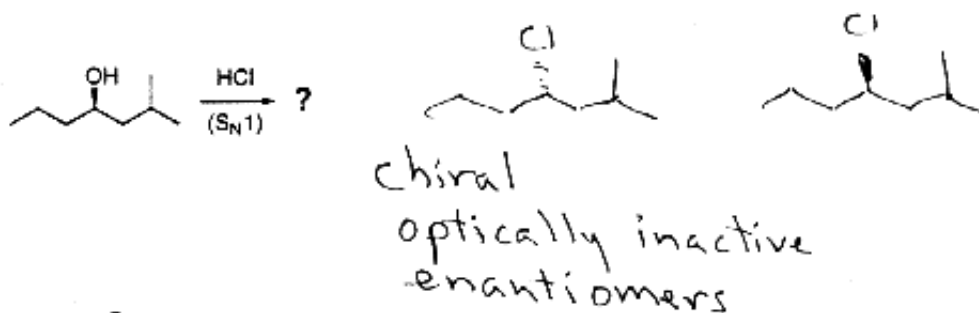


2. (20 points) All of the starting materials shown below are optically active. Provide the missing product(s) for the reactions given. Indicate whether the products will be chiral or achiral. If the products are chiral, indicate whether they will be optically active or racemic. If more than one compound will be generated, indicate the relationship between the products created (structural isomers, diastereomers, enantiomers, or none of the above).

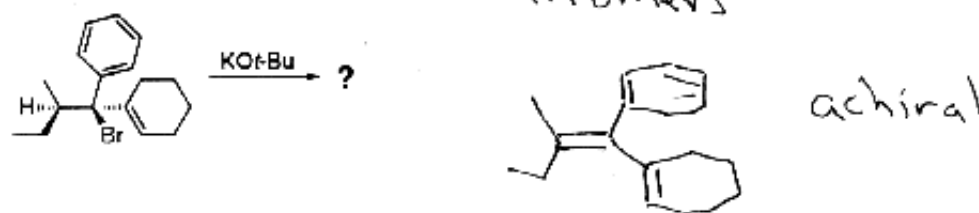
A.



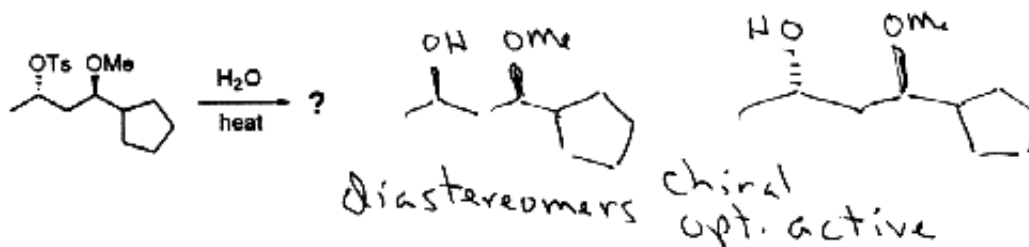
B.



C.



D.

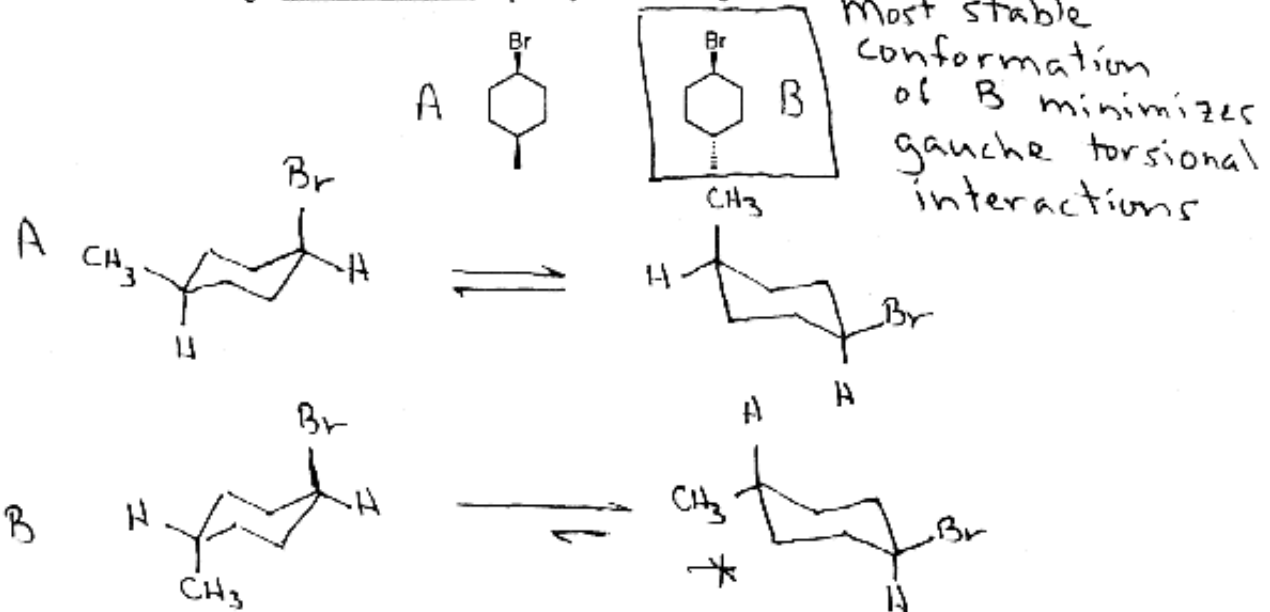


E.

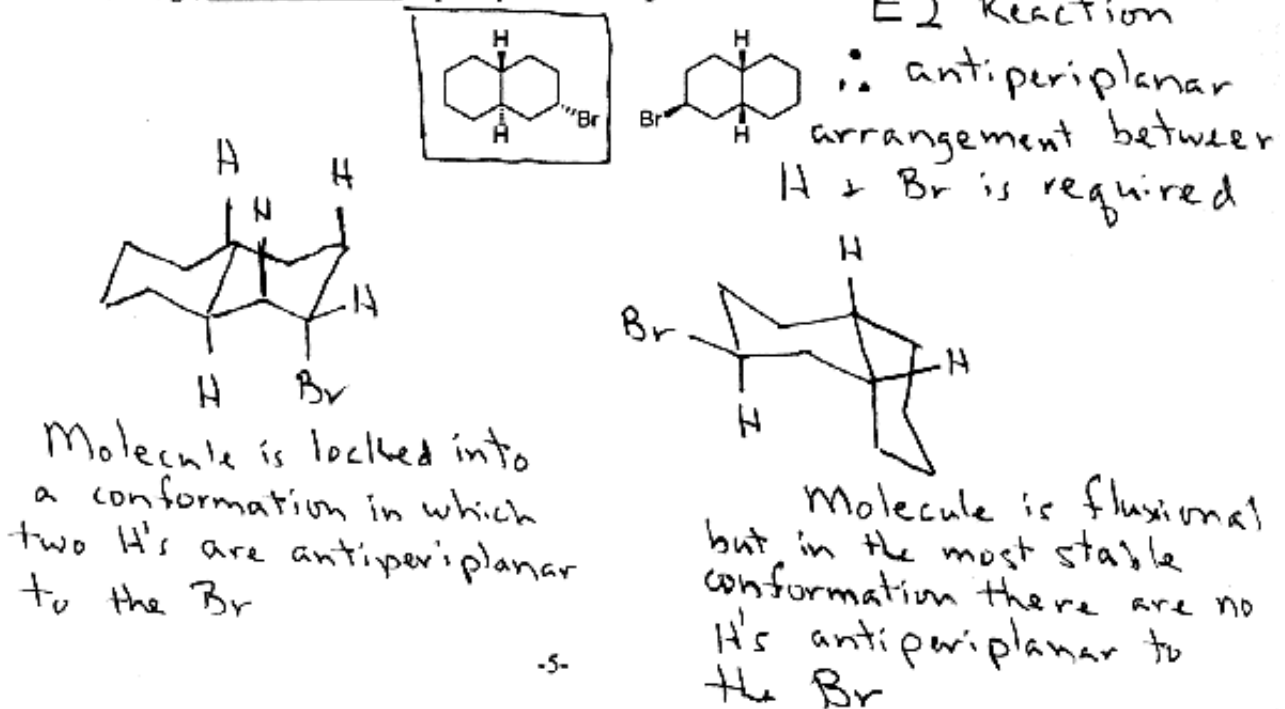


3. (30 points) For the two parts below, make certain that your structures are neatly drawn and anatomically correct.

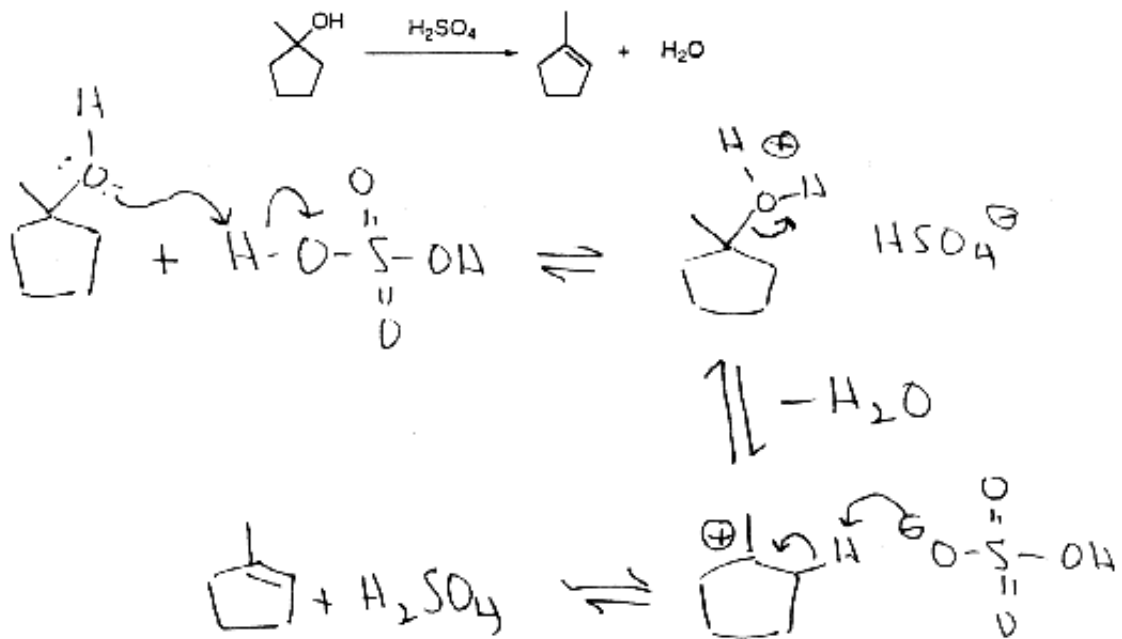
A. Of the two diastereomers shown below, which is the more stable? Utilizing appropriate drawings, **VERY BRIEFLY** explain your reasoning.



B. Of the two isomers shown below, which is the more reactive with KO₂-Bu? Utilizing appropriate drawings, **VERY BRIEFLY** explain your reasoning.



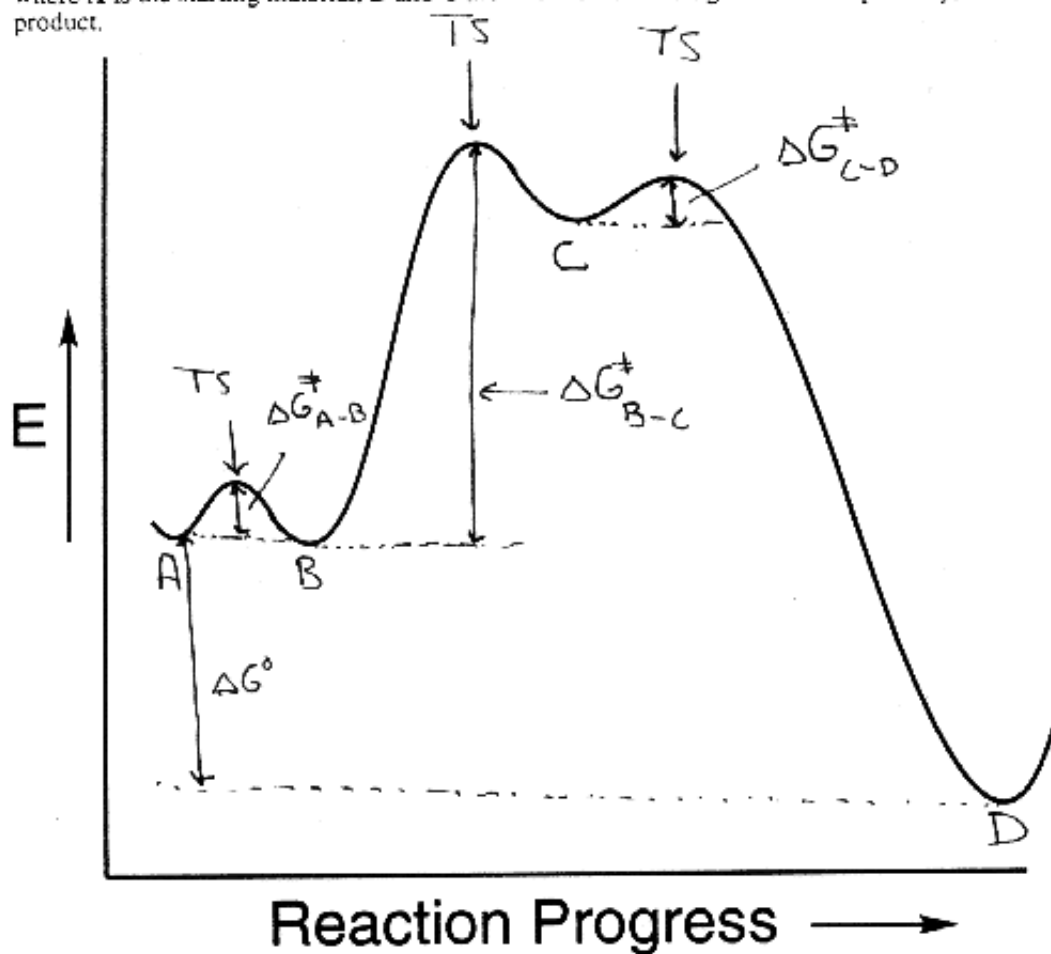
4. (20 points) Using the arrow formalism, draw a detailed, stepwise mechanism for the following transformation.



5. (15 points) Consider the following diagram that outlines the reaction progress for a hypothetical reaction:



where **A** is the starting material, **B** and **C** are intermediates along the reaction pathway, and **D** is the final product.



- A. Carefully label the positions of A through D on the diagram.
- B. Carefully label the positions of each transition state with an arrow and "TS".
- C. Carefully label each energy of activation.
- D. Carefully label the Gibbs free energy for the reaction.
- E. Is this reaction exergonic or endergonic? Exergonic
- F. What is the rate-determining step for the process? $B \rightarrow C$