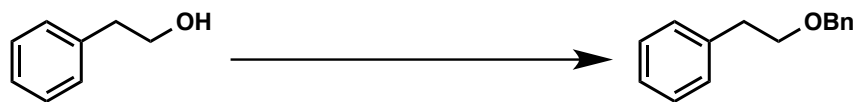


READ!!!! You may use only a model kit, a pencil, and scratch paper to answer the following. Look through the entire exam and do the easier and faster problems first. Read all directions carefully and write your answers in appropriate spaces. Answers on the backs of pages will not be graded. Note that the bonus problem at the end of the test is significantly harder and more time consuming than the regular test questions (35 possible bonus points total).

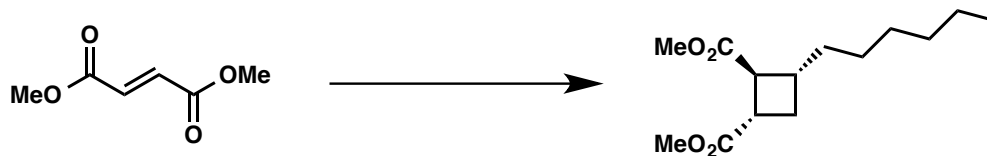
1. Write reagents over the arrows in the reactions below to perform the following transformations. If multiple steps are required, label them with "1)", "2)", etc. Partial credit is possible if correct intermediates are drawn.

A) (5 points)

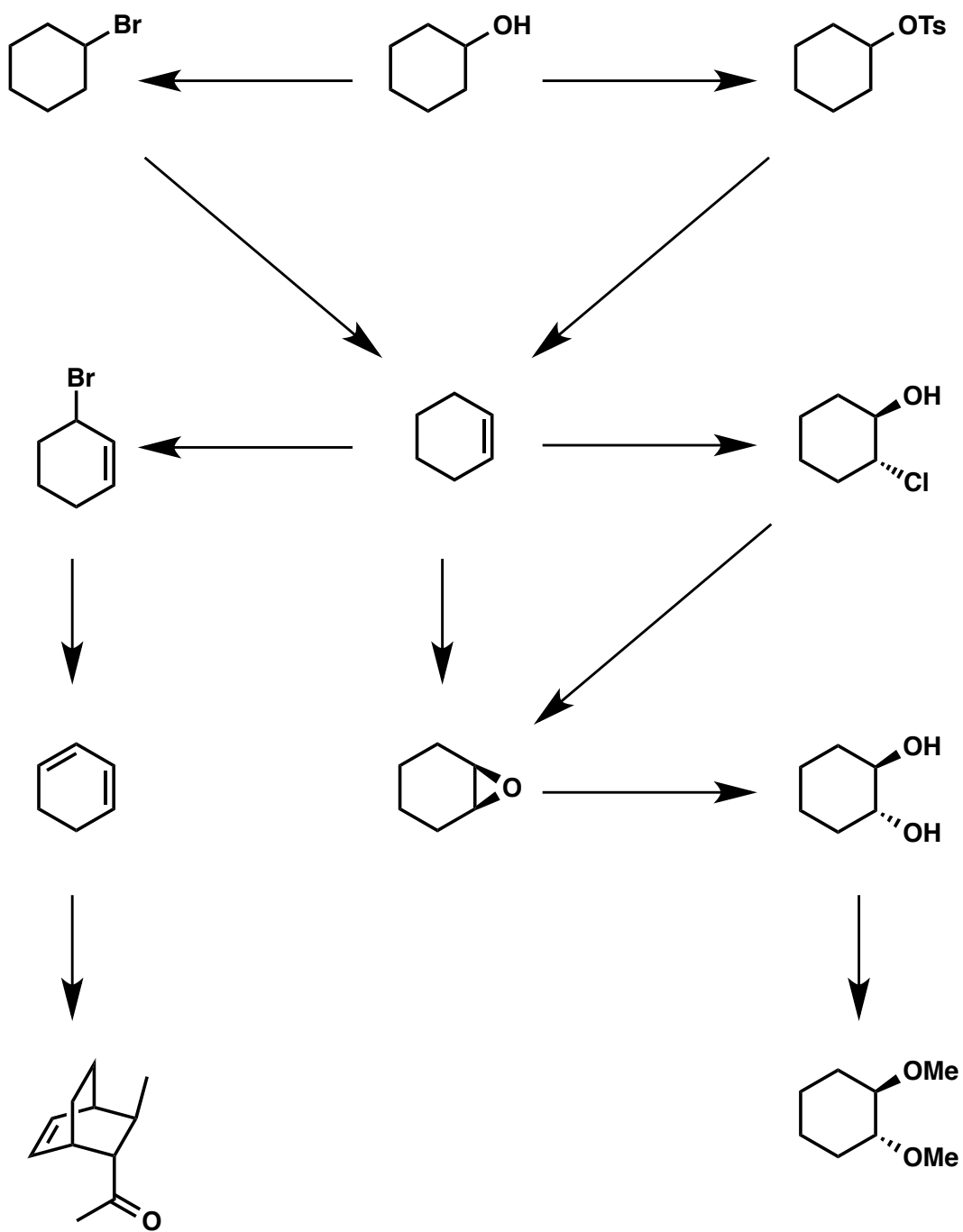
C.



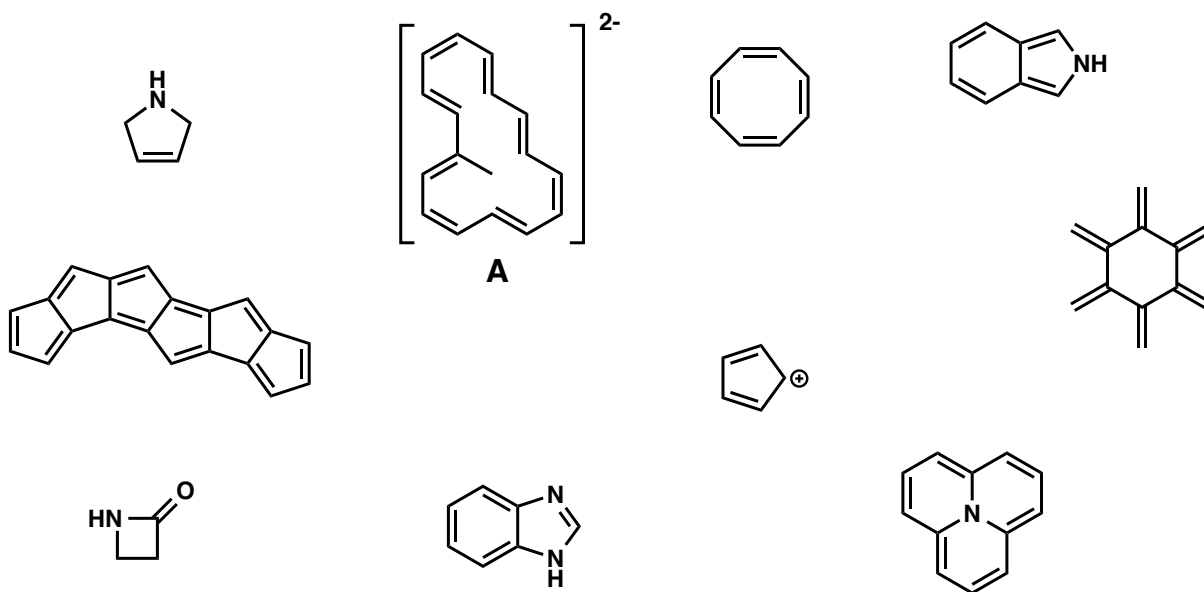
B) (5 points)



C) (5 points for each arrow, 60 total)



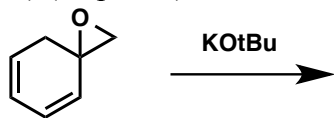
2. Label each of the following structures as “Aromatic”, “Antiaromatic”, or “Nonaromatic”.
(5 points each; 50 points total)



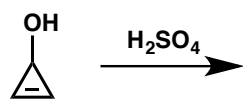
<<BONUS (5 points): Give an approximate chemical shift (in ppm) for the ^1H NMR of the methyl group in the annulene with the -2 charge, compound A.>>

3. Show the stabilized charged intermediate that results from each of the following. Draw all of the relevant resonance structures that show how the charged intermediate is stabilized.

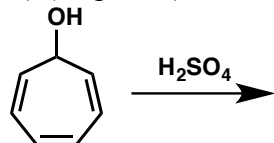
A) (10 points)



B) (10 points)



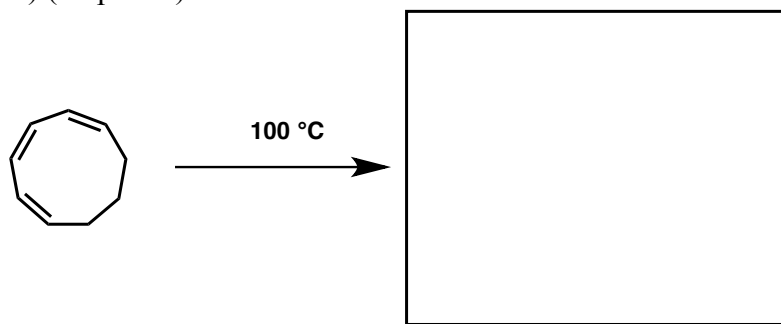
C) (10 points)



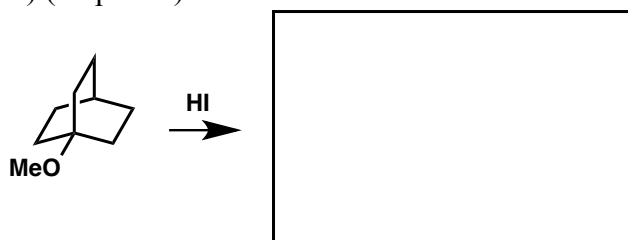
D. Draw a Frost Circle/Diagram for the ionic intermediate produced in (C). (5 points)

4. Predict the major products when the compounds on the left are treated with the indicated sets of conditions.

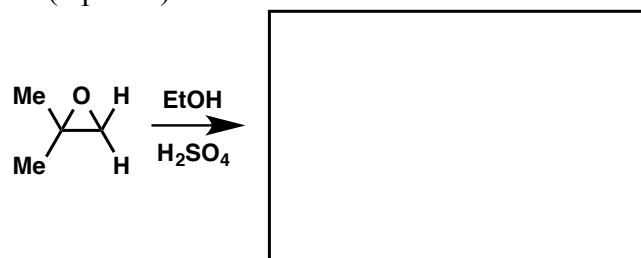
A) (15 points)



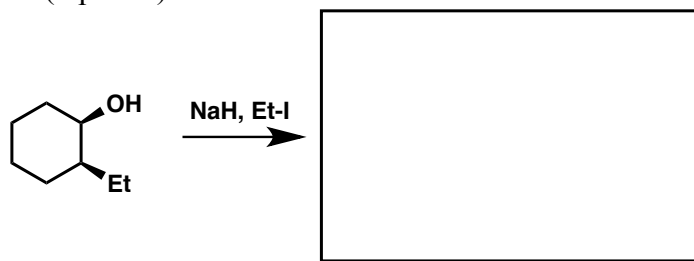
B) (15 points) Draw a mechanism for this reaction.



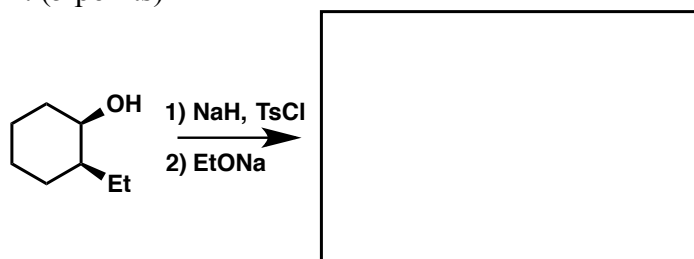
C. (5 points)



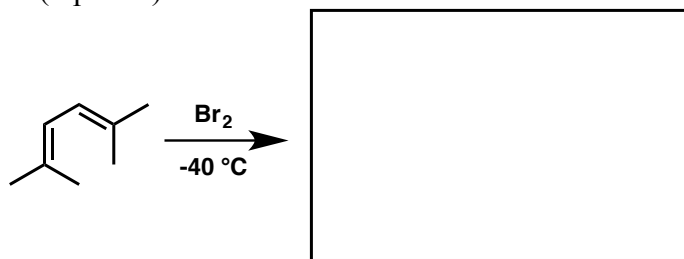
D. (5 points)



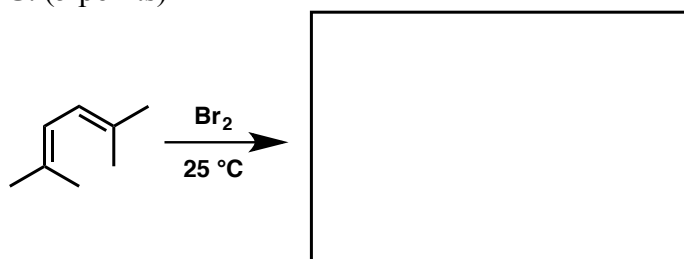
E. (5 points)



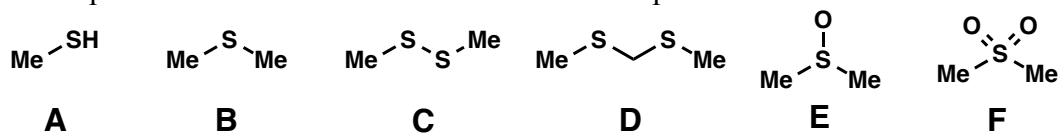
F. (5 points)



G. (5 points)



5. The following set of sulfur-based compounds are responsible for the smell found in urine after eating asparagus. The body converts methionine into A, and then uses A to produce the others. Show how you can replicate that process to convert A to 4 of the 5 other compounds in the lab.



A) A to dimethyl sulfide (5 points)

B) A to bis(methylthio)methane (5 points)

C) A to dimethyl sulfoxide (5 points)

D) A to dimethyl sulfone (5 points)

6. Provide the missing intermediate. Give a THOROUGH explanation for formation of the product in the reaction below that includes why the C-C bond formation is possible and why the illustrated stereochemistry is obtained. Use molecular orbitals where applicable. (25 points)



7. Which of the following compounds has the highest boiling point? Which has the lowest?

A. (5 points)

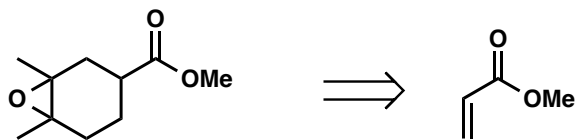
n-Butanol, diethyl ether, butane

B. (5 points)

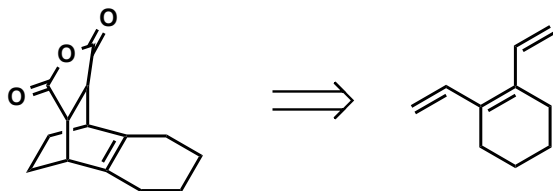
tetrahydrofuran, diethyl ether, dimethyl ether

8. Show how to synthesize the compounds on the left from the compounds on the right.

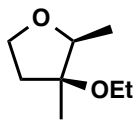
A) (10 points)



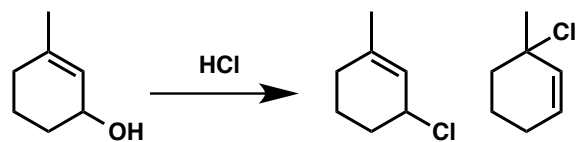
B) (10 points)



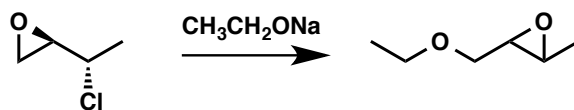
9. Synthesize the following from starting materials or reagents that add FIVE carbons or less to the product. Describe why you think this stereochemistry would result from your proposed synthesis.
(25 points)



10. Draw the mechanism of the following transformation. Push arrows and show EVERY step!
(15 points)



11. BONUS (20 PTS) Provide a full arrow-pushing mechanism for the following and show the stereochemistry for the final product:



12. BONUS (10 points) Explain why the molecule on the left is more stable than the compound on the right.



END OF TEST