

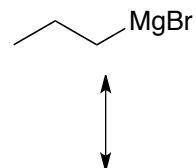
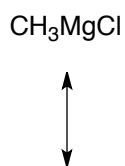
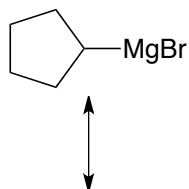
Score (4 pts)

Lectures

3-5

Name

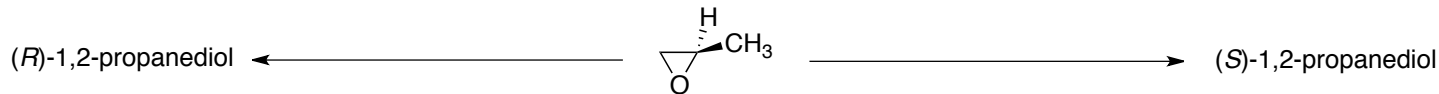
1. Draw no-bond resonance structures for each of the following Grignard reagents. Include all electron lone-pairs and all formal charges.



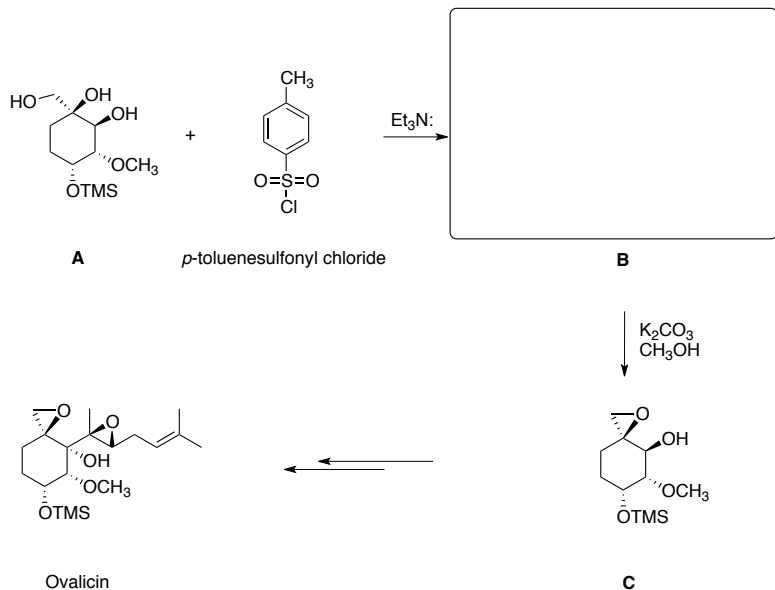
2. Draw the alcohol when each Grignard reagent above is added to benzaldehyde followed by dilute aqueous acid.

3. A chemist reacted phenyl magnesium bromide with acetone. After acidic workup, the GC chromatogram showed a mixture of only benzene and acetone and none of the expected product. **First**, draw the expected product. **Second**, explain what might have gone wrong in the experiment and suggest some techniques that may solve the problem.

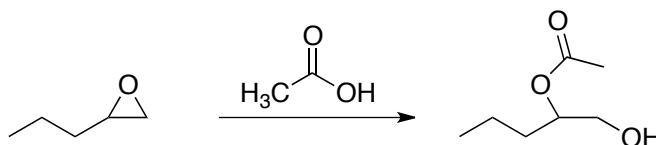
4. What reaction conditions would allow you to carry out each of the following stereospecific transformations?



5. The growth of new blood vessels angiogenesis is a crucial embryonic development. Abnormal angiogenesis is associated with tumor growth, suggesting that inhibition of angiogenesis may be an approach for the treatment of cancer. The diepoxide, ovalicin, is an angiogenesis inhibitor that was synthesized from compound C, which was in turn prepared from compound A by a two-step sequence. **First**, draw the structure for compound B. **Second**, draw a mechanism for the conversion of B to C.

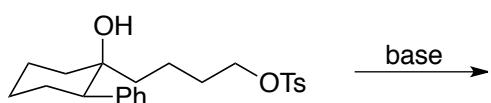


6. The epoxide below can be opened with acetic acid. Draw the complete mechanism. Show all electron lone-pairs, formal charges and curved arrow notation.

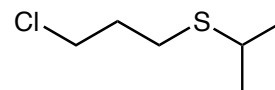
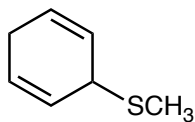
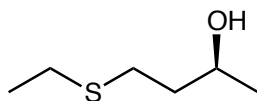
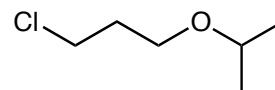
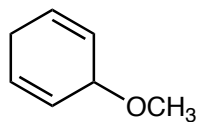
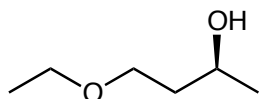


7. The reaction in the previous question is regioselective. Draw the transition state for the rate determining step above and then use that to explain why nucleophilic addition takes place at the most substituted carbon of the epoxide. Transition states should include partial charges and dashed lines (----) to indicate partial bond formation or cleavage.

8. The *p*-toluenesulfonate (OTs) undergoes intramolecular Williamson reaction on treatment with base to give a spirocyclic ether. Draw the structure of the product.

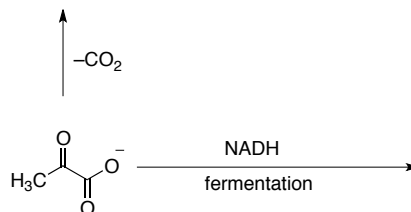
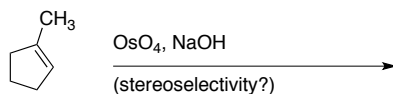
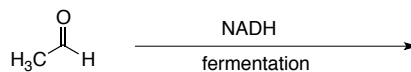
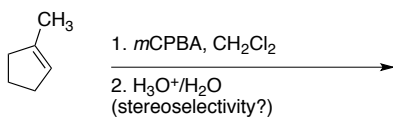
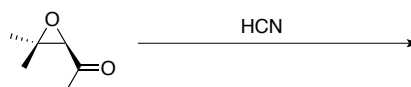
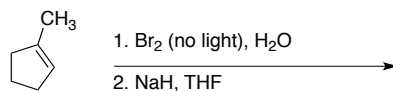
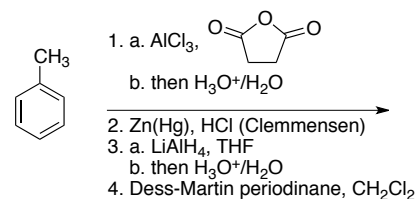
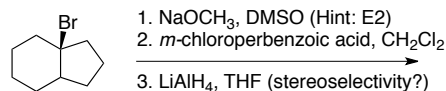
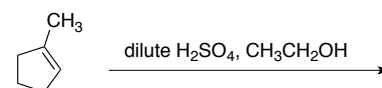
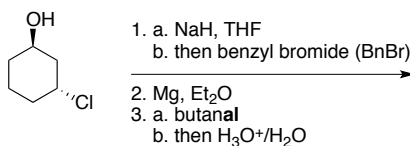
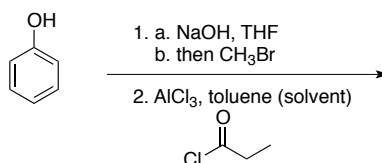
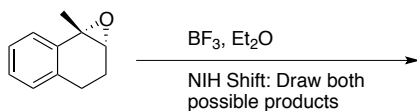
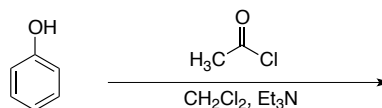
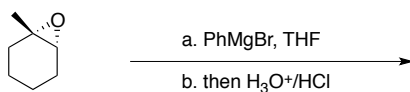
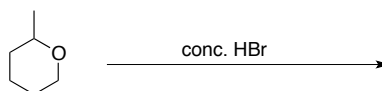
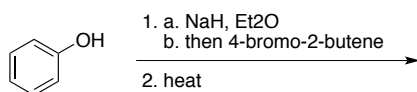


9. Provide IUPAC names for the following ethers and thioethers.



10. A chemist mixed equal parts of butanol and methanol together in sulfuric acid. Three condensation products that were ethers were isolated. Draw all three structures.

11. Draw the major product. If more than one regioisomer or stereoisomer exists, draw the major.



12. Design a synthesis for each of the following molecules. Where stereochemistry is shown, you synthesis must be stereoselective.

