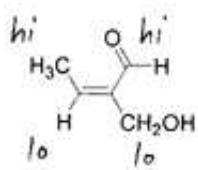
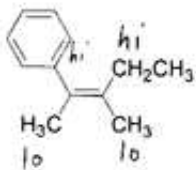


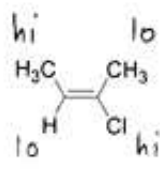
1a) Label each of the following alkenes as *E* or *Z*. (9 pts)



Z



Z

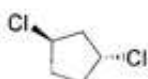


E

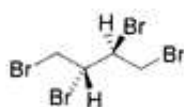
1b) Label each structure using the following choices: **Chiral**, **Achiral**, or **Achiral, meso** (9 pts).



chiral

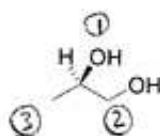


chiral

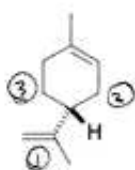


achiral, meso

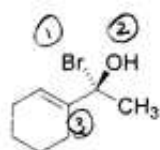
1c) Assign each chirality center as *R* or *S* (6 pts).



R

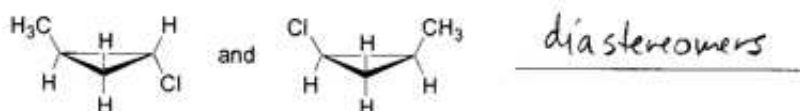
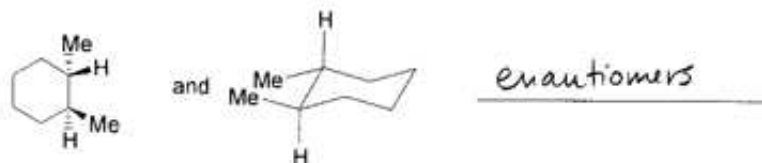
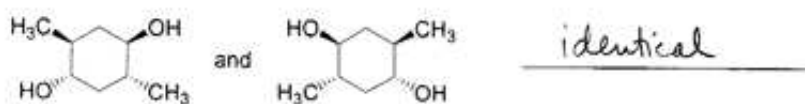


R

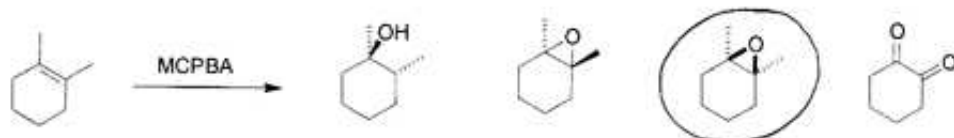
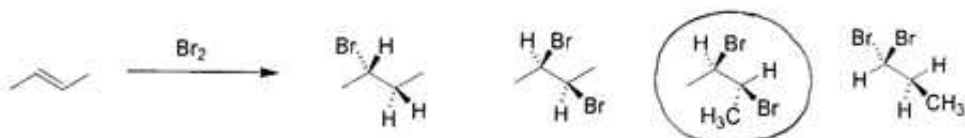
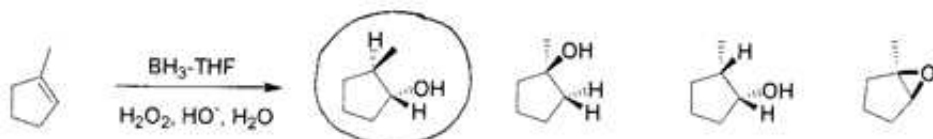


R

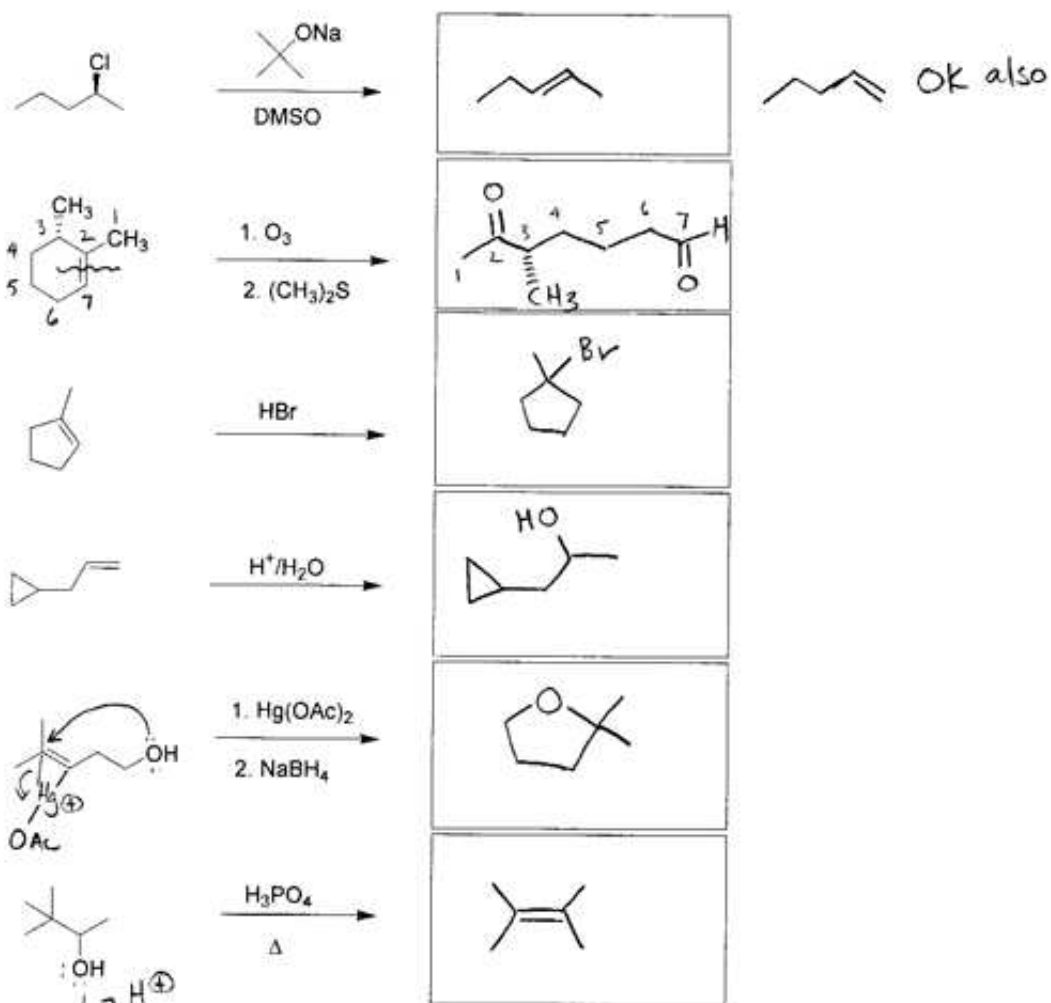
2a) For each pair of molecules, indicate whether the two structures are enantiomers, diastereomers, constitutional isomers, or identical (12 pts).




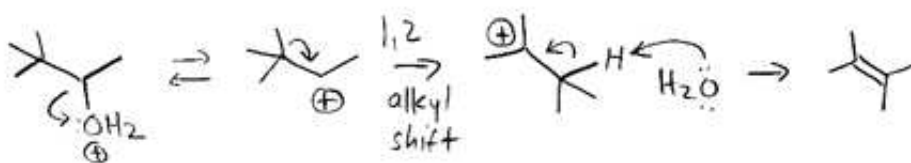
2b) Circle the correct product of each reaction (9 pts).



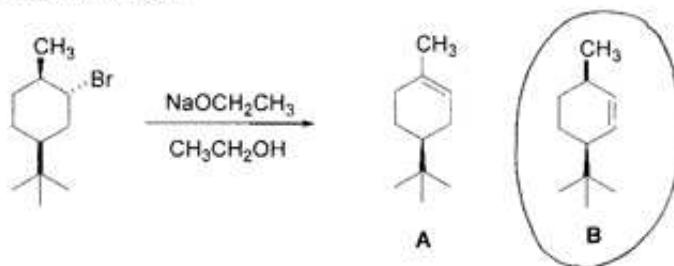
3) Provide the major organic product of each of the following reactions. If no reaction would occur, write N.R. (24 pts).



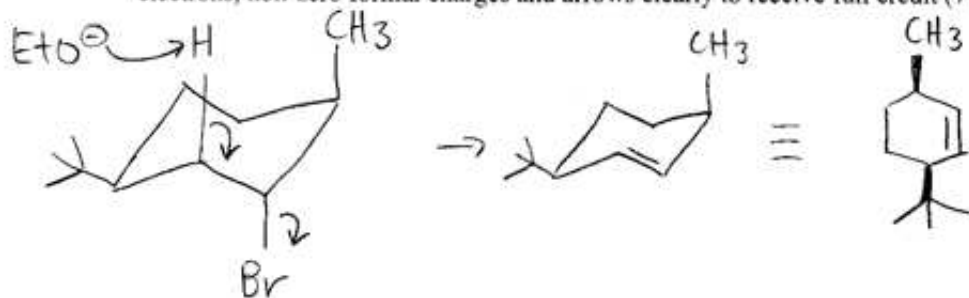
 OK also



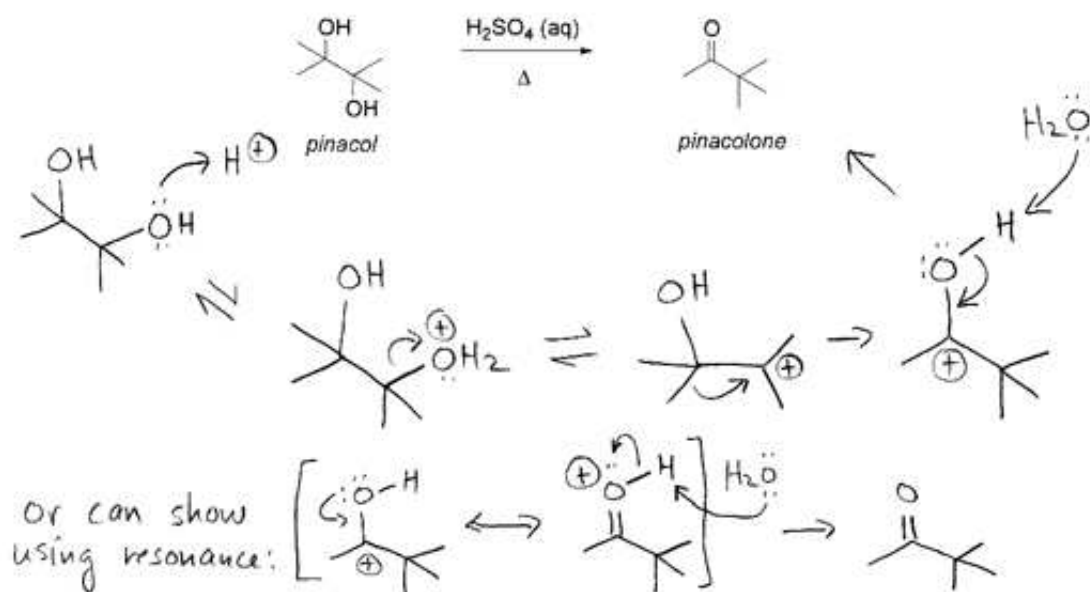
4a) Only one of the products shown in this reaction is correct. Which is it, A or B? Circle the correct product (1 pt).



4b) Explain the formation of the product you selected for 4a by drawing appropriate chemical structures and an arrow-pushing mechanism. Show all bonds, necessary electrons, non-zero formal charges and arrows clearly to receive full credit (7 pts).



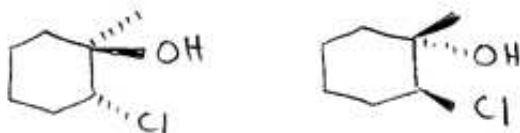
4c) The reaction shown here is called the *pinacol rearrangement*. The reaction mechanism uses patterns you have seen in your study of organic chemistry so far. Propose a mechanism for the pinacol rearrangement. Show all bonds, necessary electrons, non-zero formal charges and arrows clearly to receive full credit (7 pts).



5. Consider the following reaction:



5a) Draw the two products that will result from this reaction. Indicate the stereochemistry in each product by using wedge and dash notation (4 pts).



5b) What is the stereochemical relationship of your products? Circle it (2 pts):

**Enantiomers**

**Diastereomers**

**Identical**

5c) Is the product mixture optically active (2 pts)?:

**Yes**

**No**

5d) Draw an arrow-pushing mechanism showing the formation of either product (not both!). Show all bonds, necessary electrons, non-zero formal charges and arrows, and indicate relevant stereochemistry *throughout your mechanism* to receive full credit. (8 pts).

