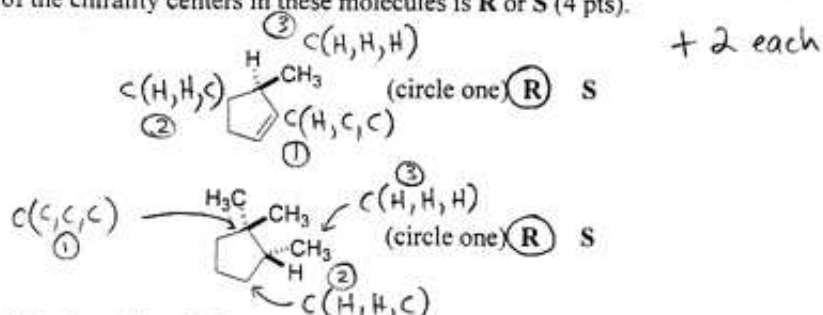


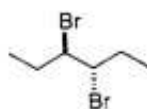
1. True/False. Circle "T" if the statement is true and "F" if the statement is false.
(10 pts) +2 each

- T (F) In hydroboration-oxidation, boron adds to the more sterically hindered carbon on the alkene.
- T (F) In an acid-catalyzed hydration reaction, distilling water out of the reaction mixture shifts the equilibrium position towards products.
- T (F) A racemic mixture is optically active.
- T (F) Optically inactive starting materials, when treated with optically inactive reagents, can produce optically active products.
- (T) F Zaitsev's rule states that the most substituted alkene product is preferentially formed in an elimination reaction.

2a) Use the Cahn-Ingold-Prelog priority rules to determine whether the configuration at each of the chirality centers in these molecules is R or S (4 pts).



2b) Chiral or Achiral? For each molecule, write "C" if it is chiral or "A" if it is achiral (6 pts).

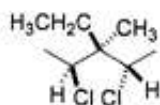


achiral

+2 each

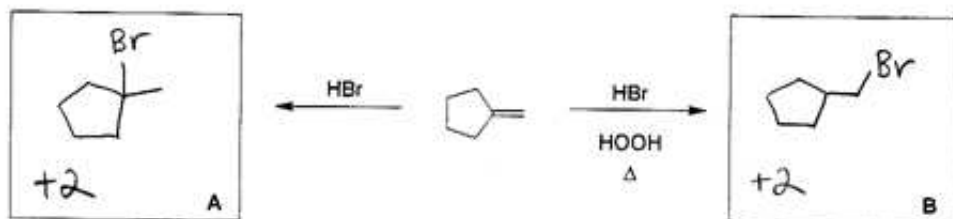


achiral



chiral

3a) Draw the structures of each product obtained when this unsymmetrical alkene is treated under the different conditions shown (4 pts).



3b) Which of the following words best describes both of the two reactions shown above? Circle that word (2 pts)

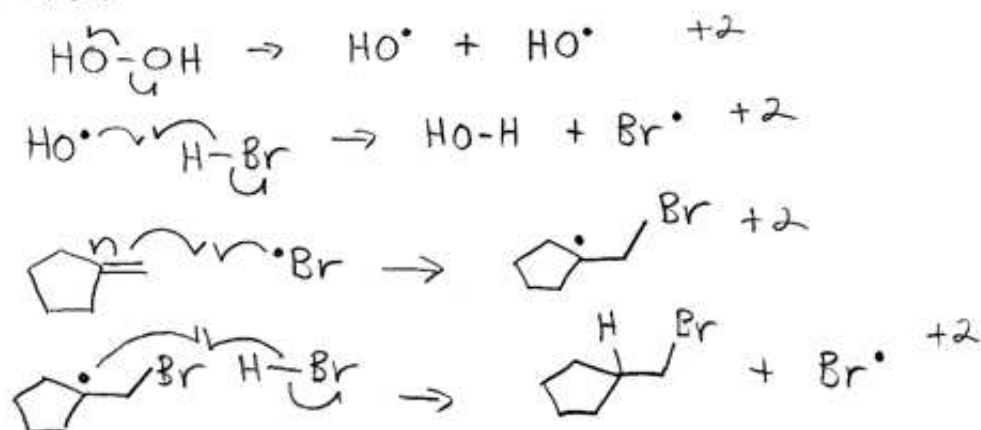
Stereoselective

Regioselective

Non-selective

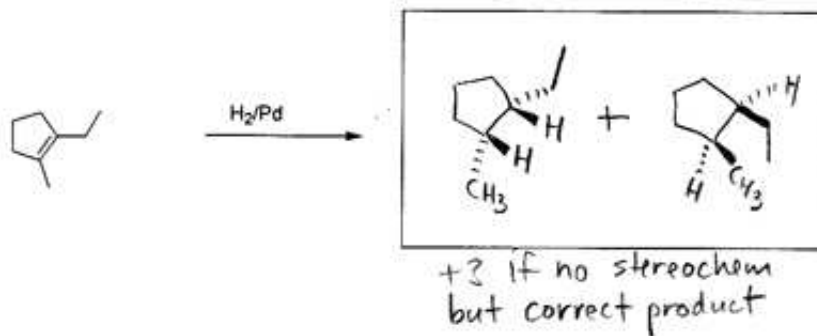
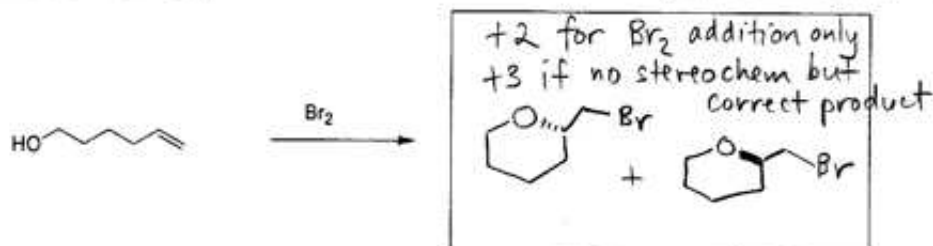
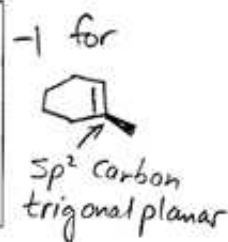
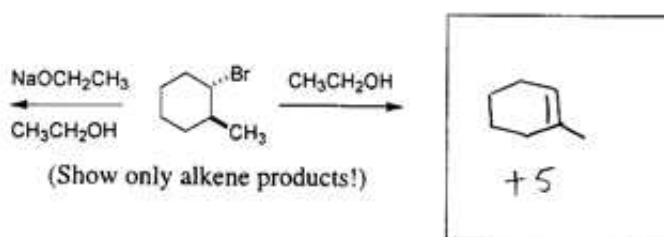
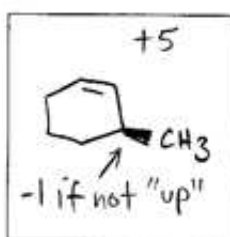
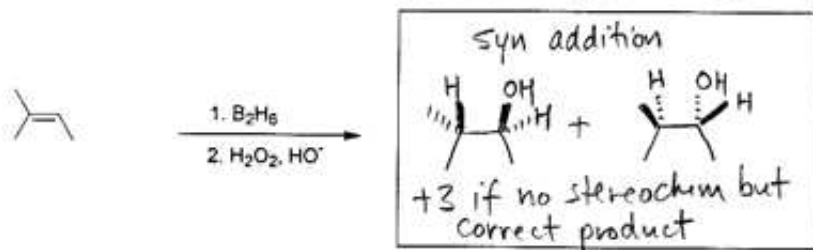
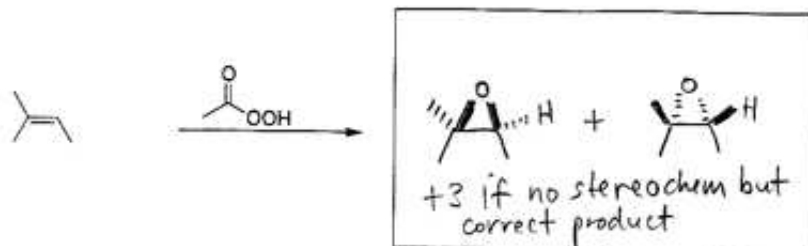
+2

3c) Provide a mechanism for the formation of product "B" from the starting alkene shown (9 pts)

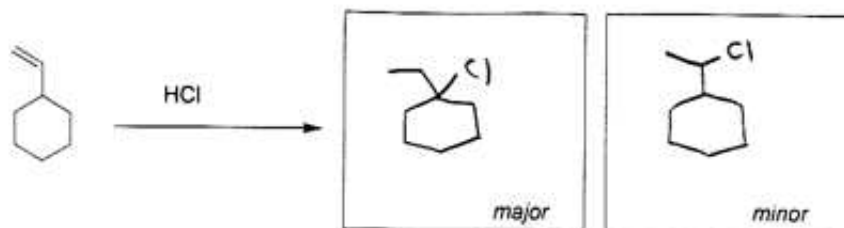


mechanism: +1 all arrows drawn properly,
all structures drawn correctly

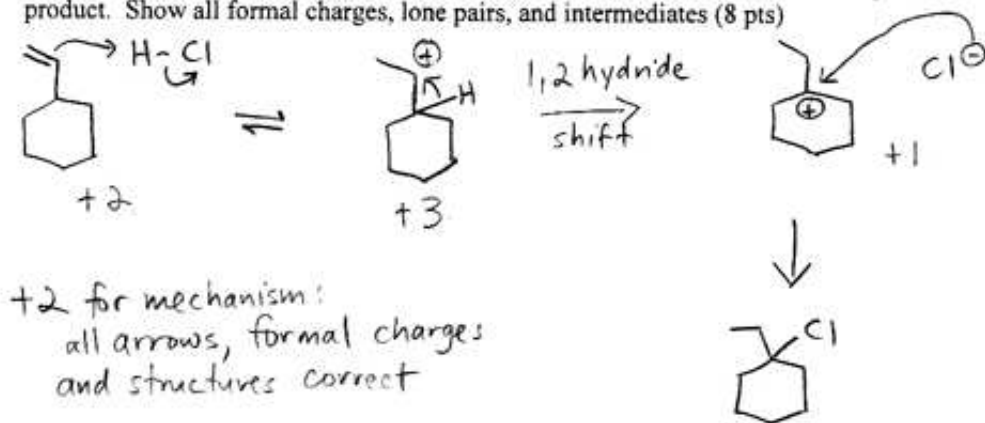
4. Predict the major organic product(s) following reaction. Show stereochemistry for all stereoselective reactions (30 pts).



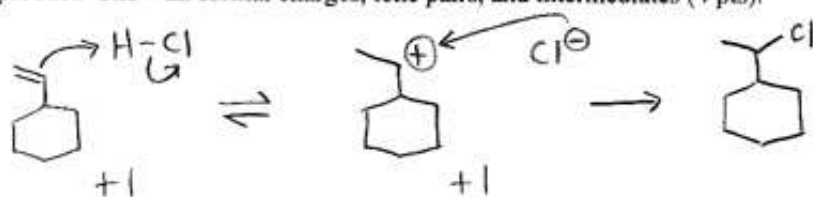
5a) Predict the major and minor products that would result from the following reaction conditions (6 pts).



5b) Draw an arrow-pushing mechanism to illustrate the formation of the major product. Show all formal charges, lone pairs, and intermediates (8 pts)



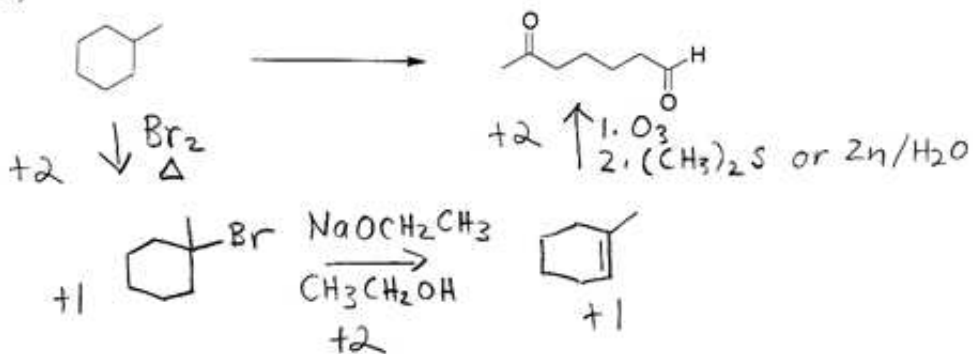
5c) Draw an arrow-pushing mechanism to illustrate the formation of the minor product. Show all formal charges, lone pairs, and intermediates (4 pts).



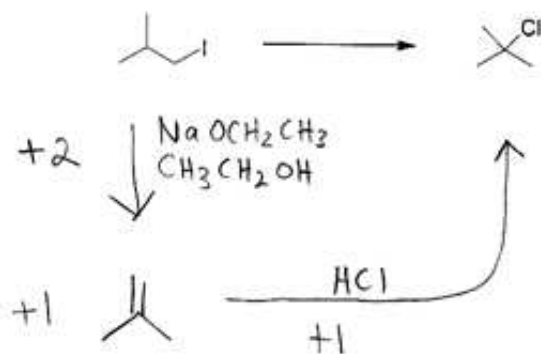
+2 mechanism: all arrows, formal charges
and structures correct

6. Given the starting material, propose a short, efficient synthetic sequence to carry out each of the following transformations. You may use any necessary organic or inorganic reagents (don't forget heat or light, too). To receive full credit, you **must list all reagents and show the major product that results from each step**. You do not have to draw any mechanisms or include stereochemistry. (12 pts).

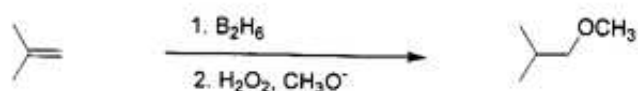
6a)



6b)



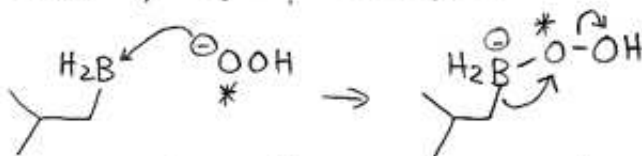
7. A chemist wishes to synthesize the ether shown at the right by treating an unsymmetrical alkene first with diborane (B_2H_6), then with hydrogen peroxide and methoxide as shown here:



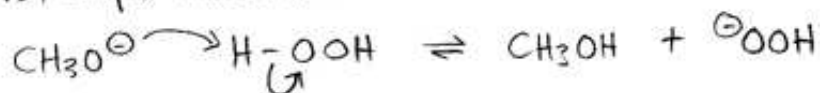
Would this reaction successfully produce the desired ether shown at right? (circle one) (1 pt) YES **NO** +1

Explain your answer using two or three sentences and a brief mechanistic argument. Do not draw the entire mechanism for the reaction, only the step or steps that support(s) your answer. (4 pts)

In hydroboration-oxidation the O atom in the resulting alcohol comes from hydrogen peroxide, not water or hydroxide:



The methoxide (CH_3O^-) would only function as a base in the first step: it does not add to the alkene



+2 for written explanation

+2 for mechanism step lending support

Also acceptable is an explanation as to why the CH_3 group would not end up transferring to carbon, but recognition that the oxygen atom isn't transferred from methoxide but rather hydroperoxide is sufficient.