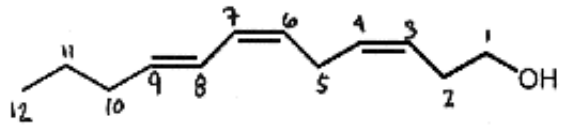
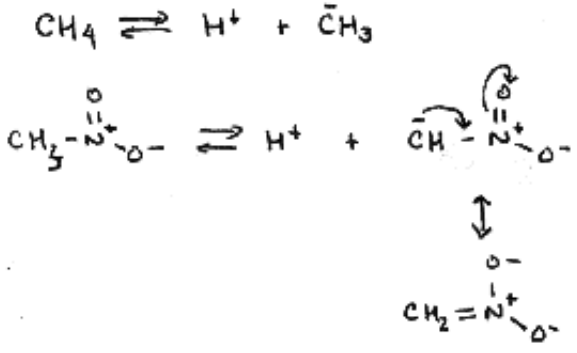
Question 1 (9 points) **Name** key

a. (5 pts) Give the correct IUPAC name for the following molecule, which is the trail pheromone of termites. Note: an alkane containing 12 carbons is dodecane.



3(Z), 6(Z), 8(E)- dodecatrien-1-ol

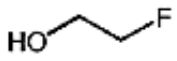
b. (4 pts) Explain using mostly pictures and as few words as possible, why nitromethane (CH_3NO_2, $pK_a = 10.2$) is more acidic than methane (CH_4, $pK_a = 49$).



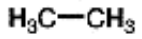
$\bar{C}H_2$-NO_2 is stabilized by resonance while $\bar{C}H_3$ is not.

Question 2 (15 points) **Name** key

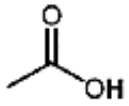
a. (12 pts) Rank the following compounds (1 (most acidic) – 6 (least acidic)) in order of decreasing acidity, increasing pK_a. The acidic hydrogens are shown in bold.



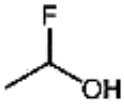
3



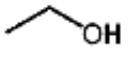
6



1



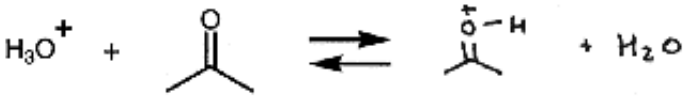
2



5

4

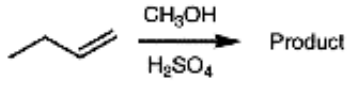
c. (3 pts) Write the products for the following reaction and indicate whether the reaction favors products or reactants.



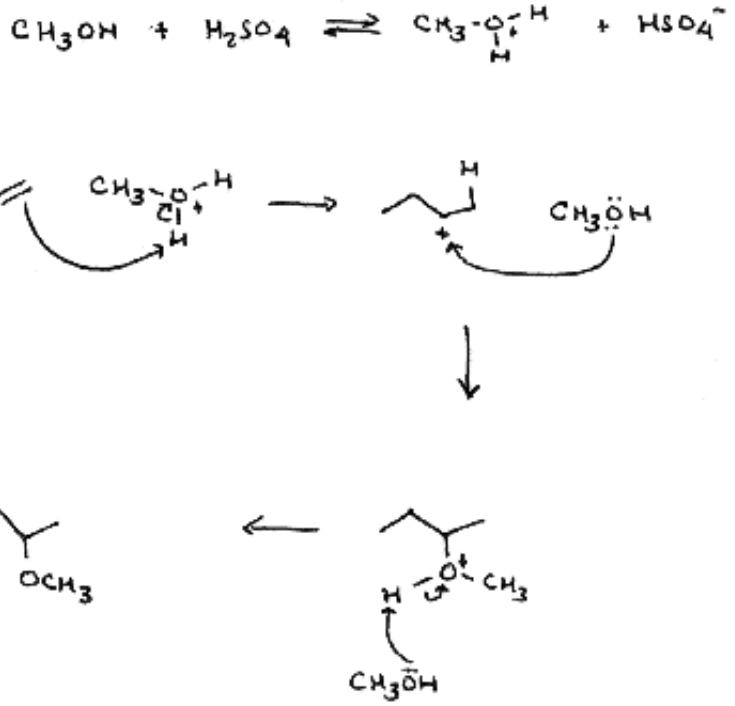
reactants are favored

Question 3 (21 points) **Name** Key

Consider the following reaction.



a. (6 pts) Using the correct curved arrow formalism, draw the best mechanism for the reaction. Be sure to draw complete structures for each intermediate.

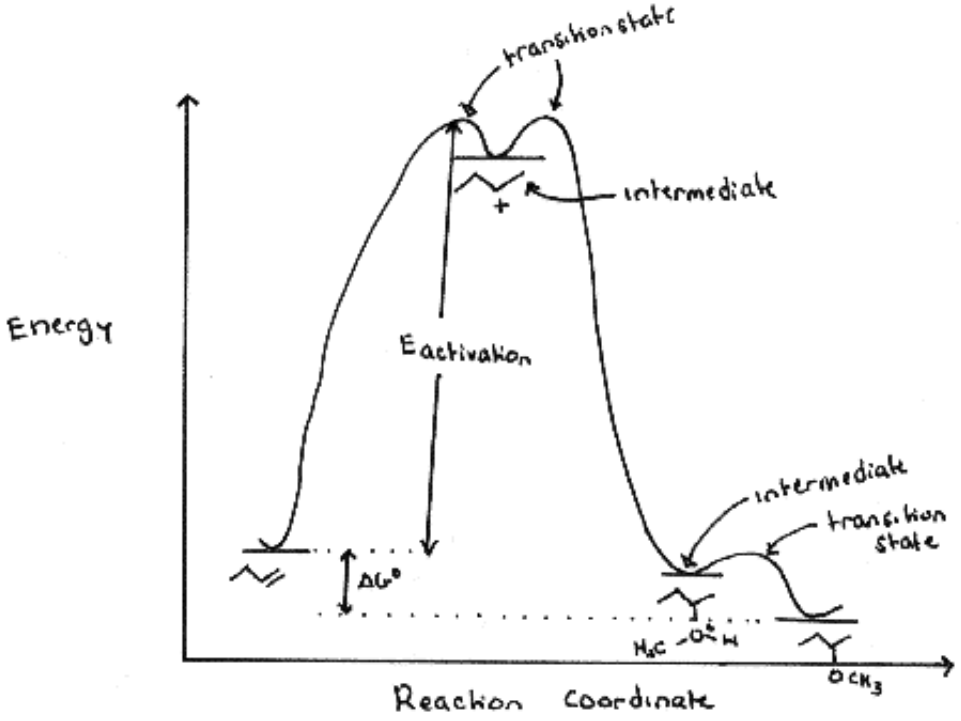


b. (2 pts) What is the name of the mechanism that is the microscopic reverse of the mechanism described in parts a and c?

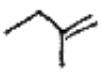
E1

Question 3 (continued) **Name** key

c. (7 pts) The reaction shown above is exothermic. Draw a reaction coordinate diagram, labeling ΔG°, $E_{activation}$, the transition state(s), the intermediate(s) if any, the reactants and the products. (If you would like, you can use letters to relate structures from part a to key features on the reaction coordinate diagram.)

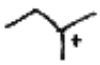


d. (6 pts) Suppose that 2-methyl-1-butene was used as the reactant instead of 1-butene for the reaction. How would the $E_{activation}$ change? Why does the $E_{activation}$ change? How does this change in $E_{activation}$ affect the rate of the reaction of 2-methyl-1-butene relative to 1-butene? Assume that the relative energies of 1-butene and 2-methylbutene are the same.



2-methyl-1-butene

Eactivation is lower



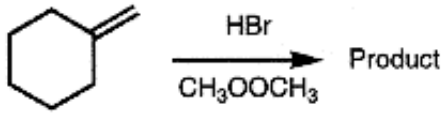
is more stable than

due to hyperconjugation.

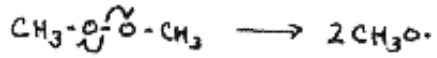
The rate for  will be faster.

Question 4 (12 points) **Name** key

Using the correct curved arrow formalism, show the best mechanism for the following reaction. Be sure to draw complete structures for all intermediates. If a radical mechanism is involved, be sure to clearly indicate the initiation and propagation steps. Explain the regiochemistry of the product.

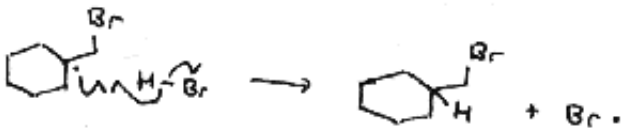


Initiation



propagation

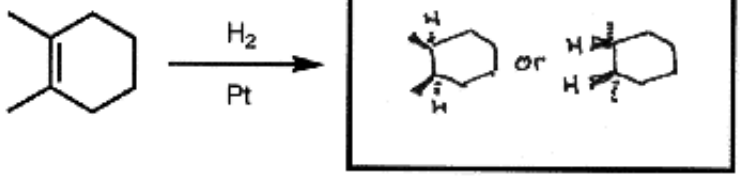
most stable radical



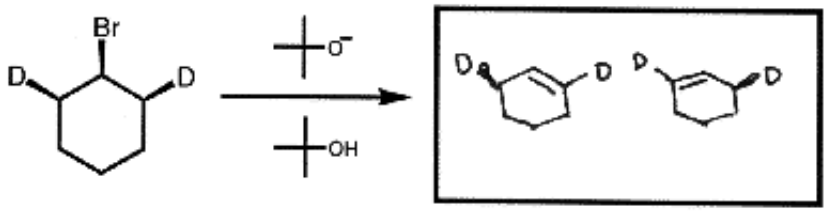
Question 5 (16 points) **Name** Key

Give the complete structure of the major organic product for the following reactions. Put your answer in the box provided. Be sure to indicate stereochemistry where appropriate.

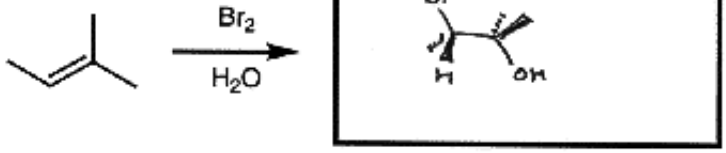
a. (3 pts)



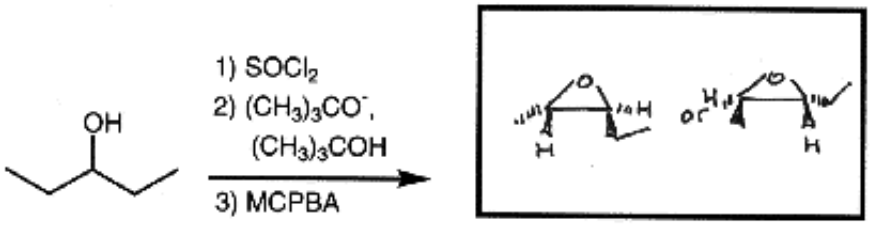
b. (4 pts)



c. (4 pts)

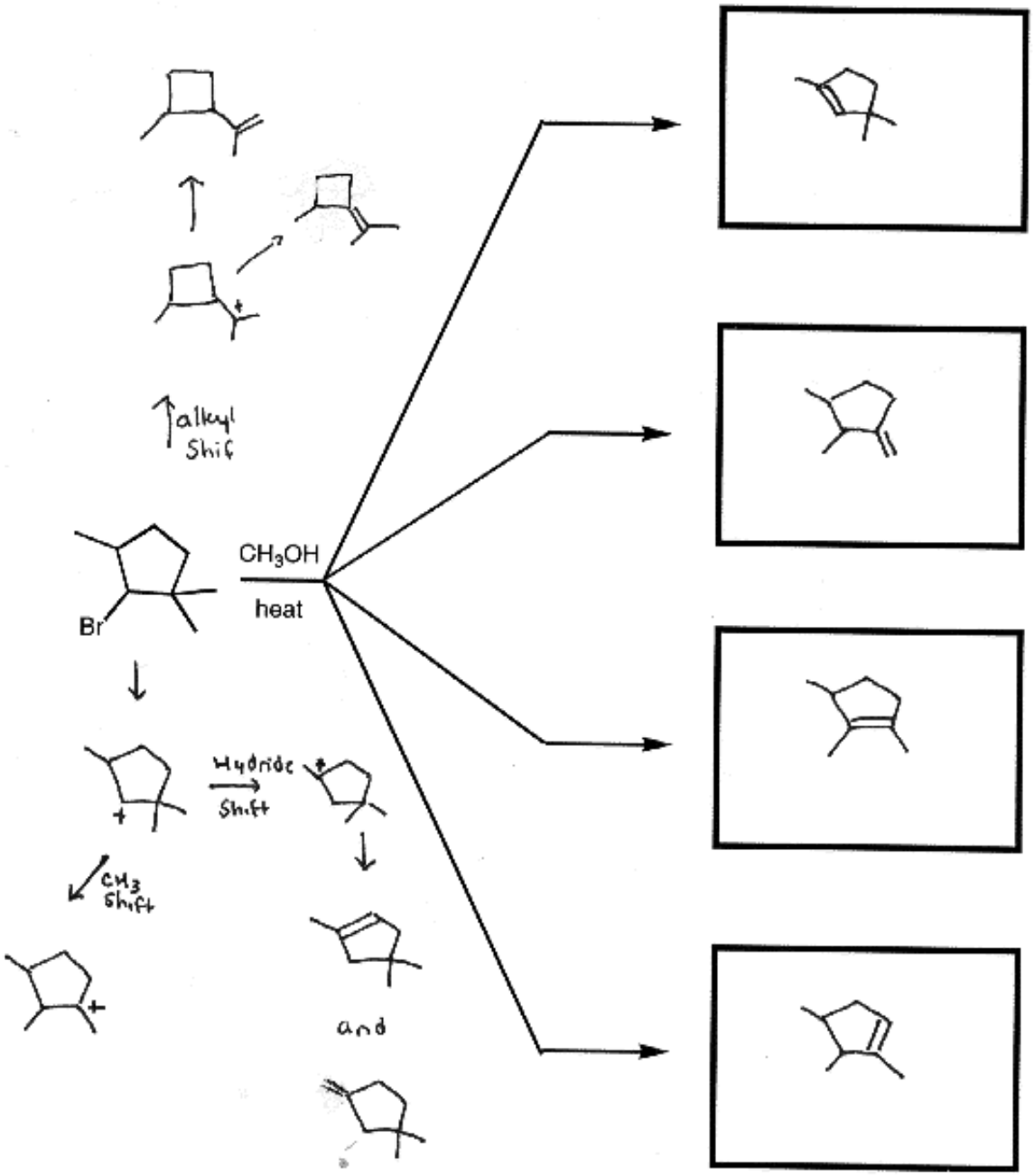


d. (5 pts)



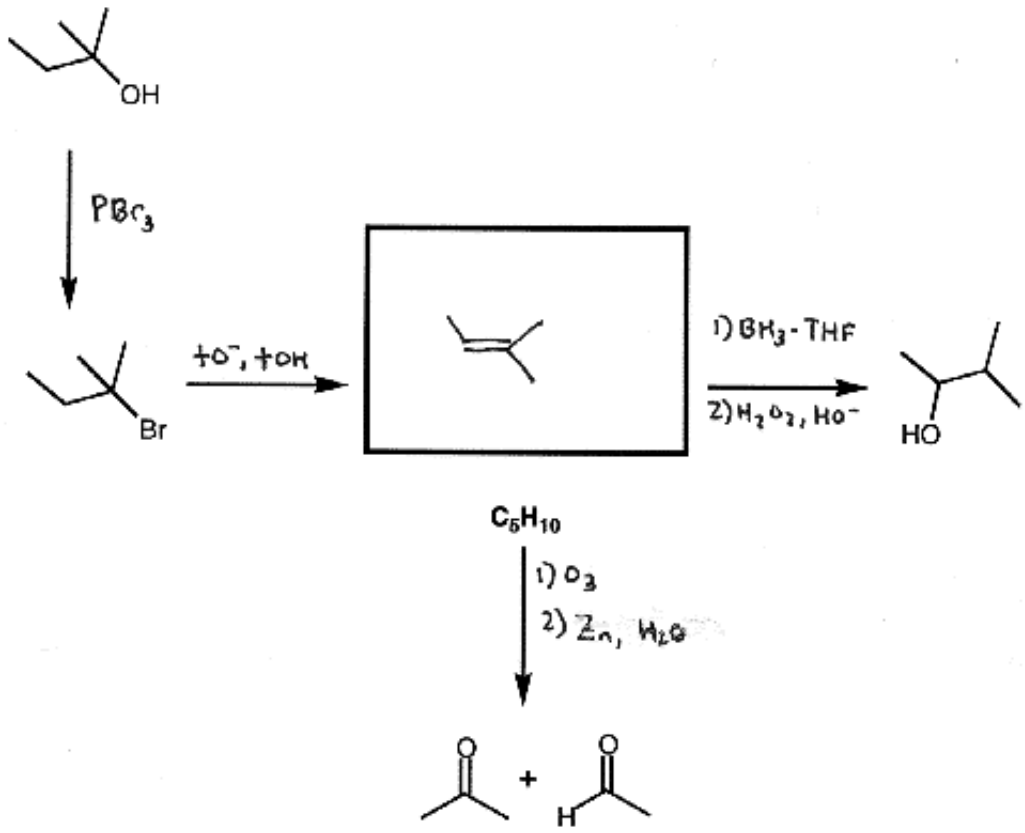
Question 6 (12 points) **Name** key

Draw complete structures for four different **alkenes** that could be formed from the following reaction.



Question 7 (15 points) **Name** key

Provide the missing reagents and products for the following transformation. The reagents should be listed in order of use if more than one synthetic step is necessary.



Extra Credit (10 points) **Name** key

Using the correct arrow formalism, draw the best mechanism for the following reaction. Be sure to draw complete structures for each intermediate.