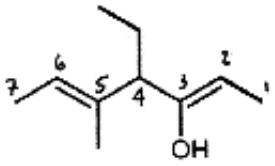
Question 1 (10 points) **Name** Key

a. (5 pts) Give the correct IUPAC name for the following molecule. You may use common names for any substituents.



4-ethyl-5-methyl-2(Z)5(E) heptadien-3-ol

b. (5 pts) Write the products for the following reaction and indicate whether the reaction favors products or reactants. Some useful pK_a's are shown below.

$CH_3OH_2^+ + CH_3NH_2 \rightleftharpoons CH_3\overset{+}{N}H_3 + CH_3OH$

pka -2.2 pka 10

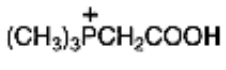
weaker acid

products are favored.

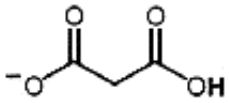
	pK_a
CH_3OH	15
$CH_3OH_2^+$	-2.2
CH_3NH_2	35
$CH_3NH_3^+$	~10

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

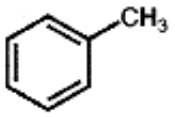
a. (10 pts) Rank the following compounds (1 (most acidic) – 5 (least acidic)) in order of decreasing acidity, increasing pK_a. The acidic hydrogens are shown in bold.



2

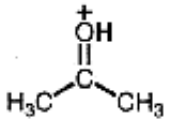


3



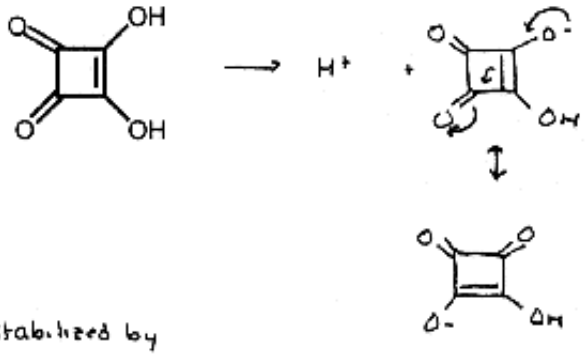
5

4



1

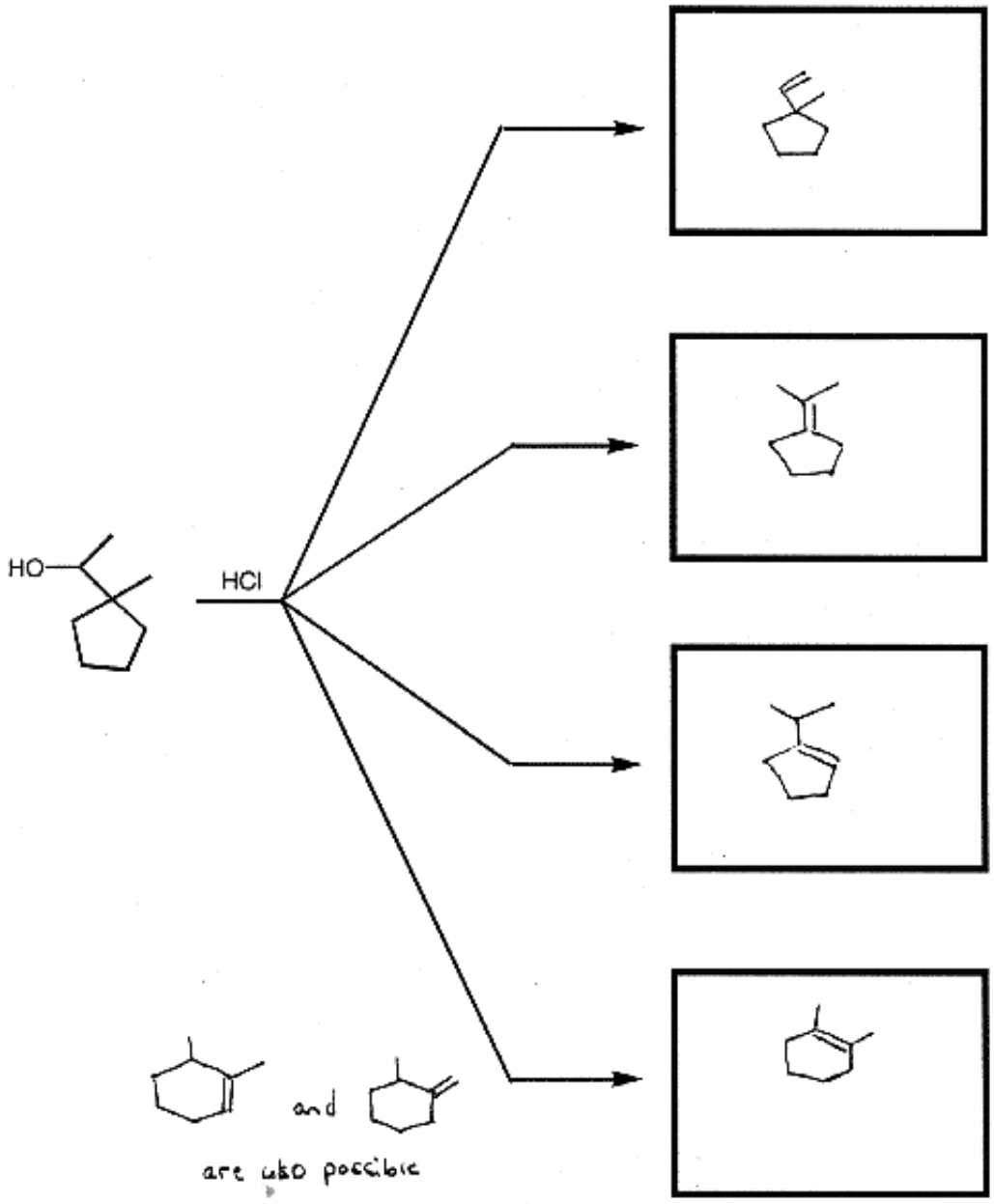
b. (5 pts) Squaric acid, shown below, is a very strong acid. The pK_a for the removal of the first hydrogen is 1.7. Explain using words and pictures, the strong acidity of the squaric acid.



Anion is stabilized by resonance

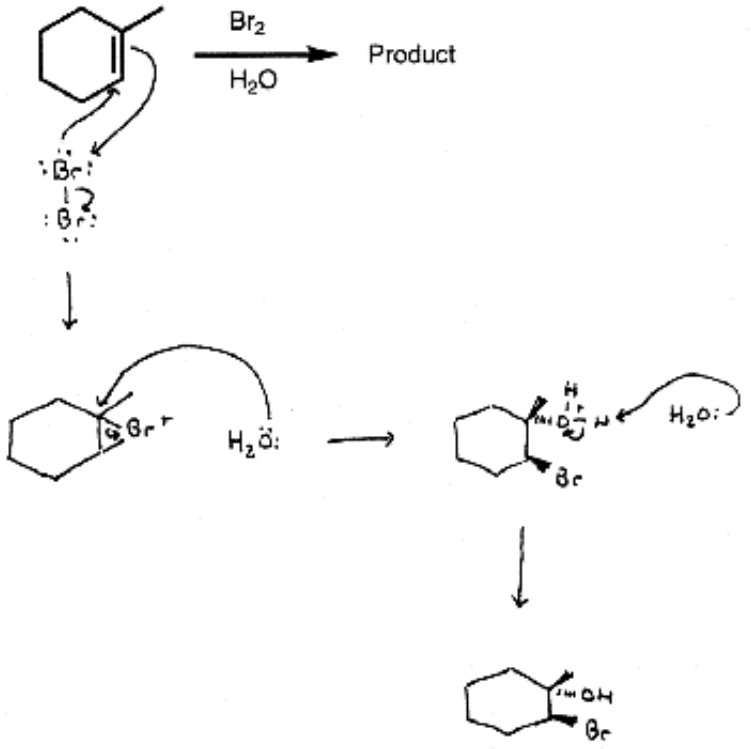
Question 3 (12 points) **Name** key

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



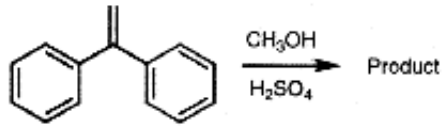
Question 4 (12 points) **Name** Key

Using the correct curved arrow formalism, show the best mechanism for the following reaction. Be sure to draw complete structures for all intermediates. Be sure to draw the correct stereochemistry for the products. Give as much detail as possible.

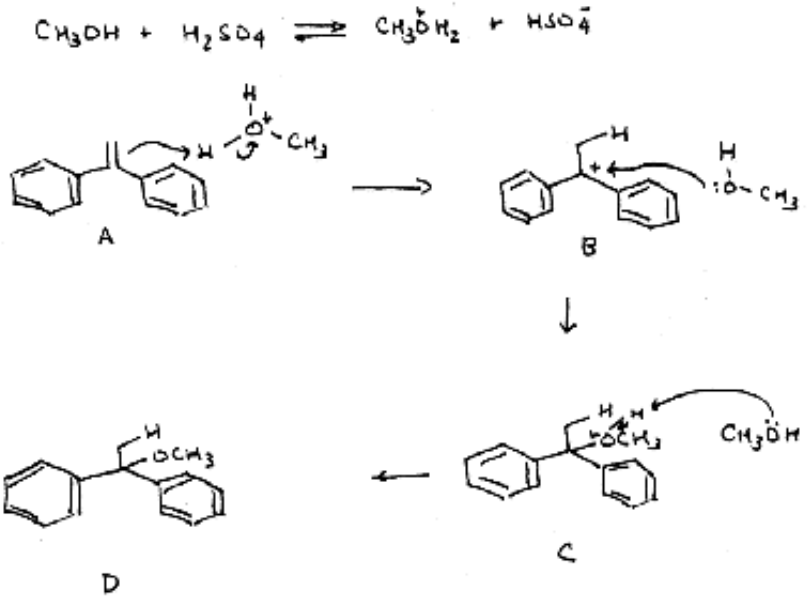


Question 5 (16 points) **Name** key

Consider the following reaction.

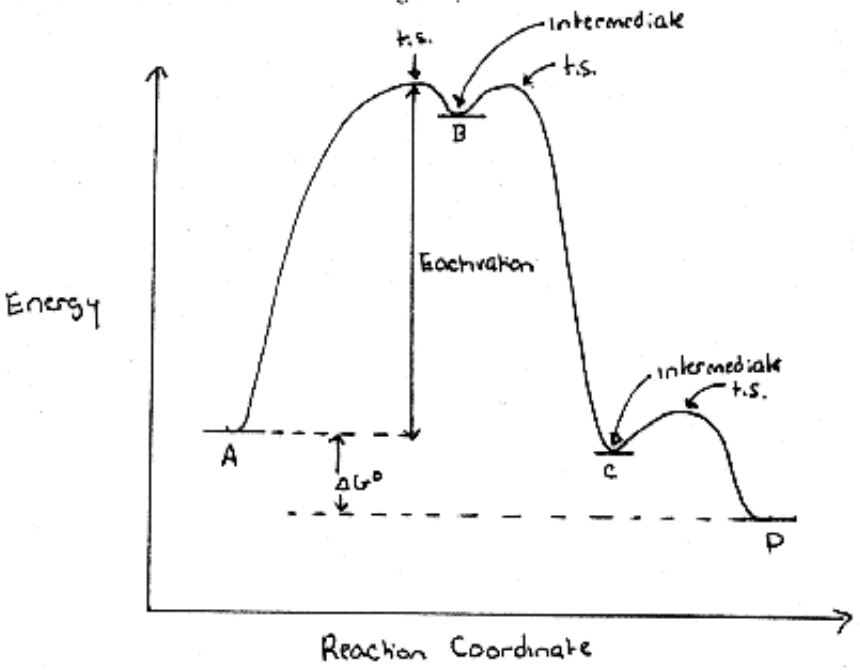


a. (6 pts) Using the correct curved arrow formalism, draw the best mechanism for the reaction. Be sure to draw complete structures for each intermediate.



Question 5 (continued) **Name** key

b. (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.)



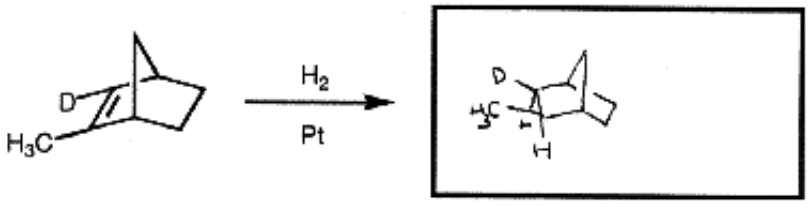
c. (3 pts) What is the name of the mechanism is the microscopic reverse of the mechanism described in parts a and b?

E1

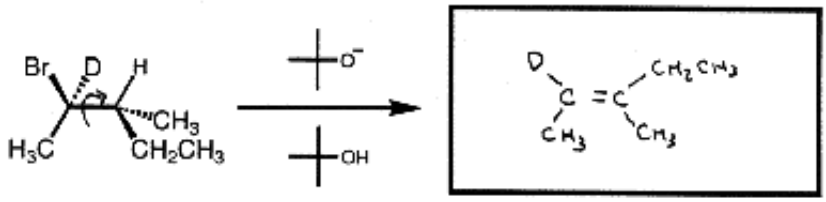
Question 6 (20 points) Name Key

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.

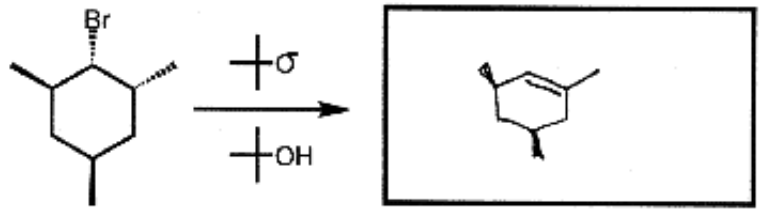
a. (3 pts)



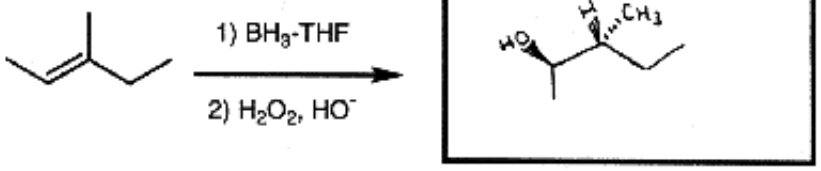
b. (4 pts)



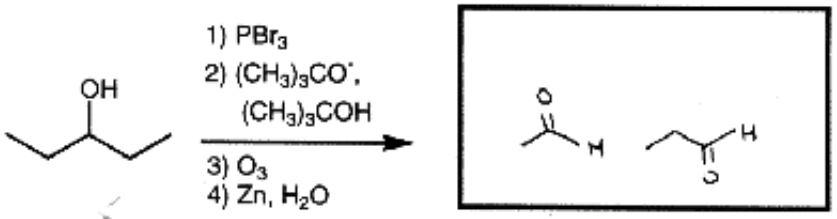
c.
d. (4 pts)



e. (4 pts)

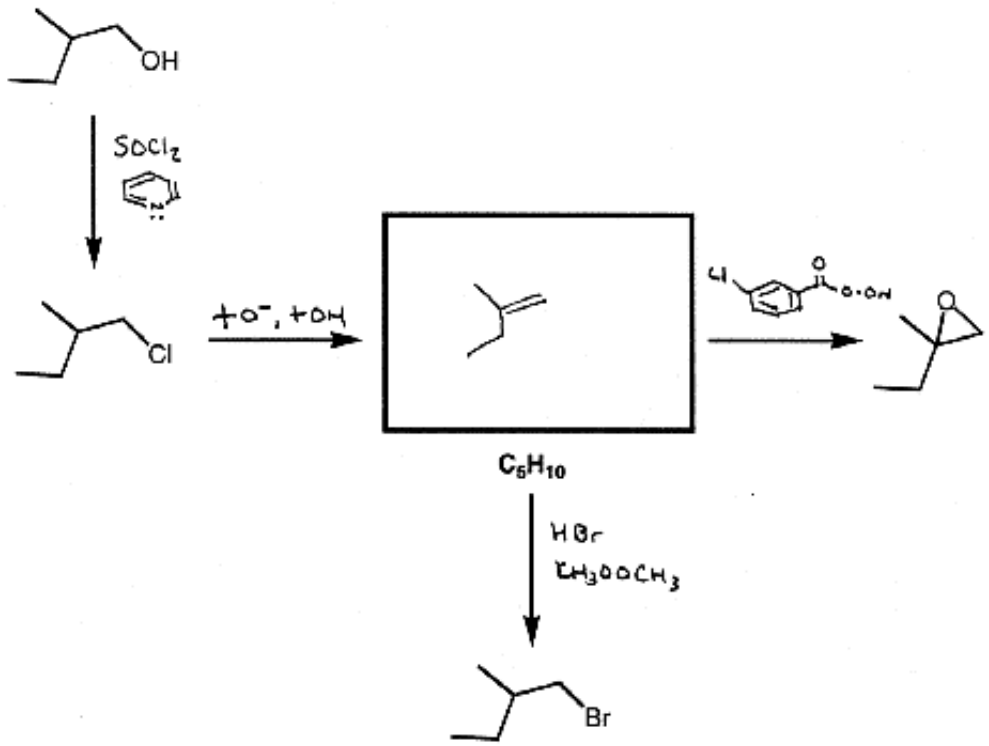


f. (5 pts)



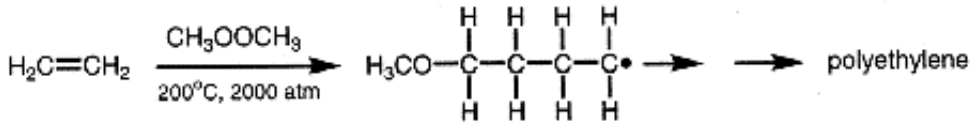
Question 7 (15 points) **Name** key

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.

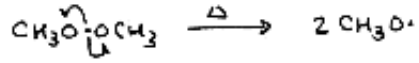


Extra Credit (8 points) **Name** key

Using the correct arrow formalism, draw the best mechanism for the formation of polyethylene from ethylene. If a radical mechanism is involved, be sure to clearly indicate the initiation and chain propagation steps.



Initiation



chain propagation