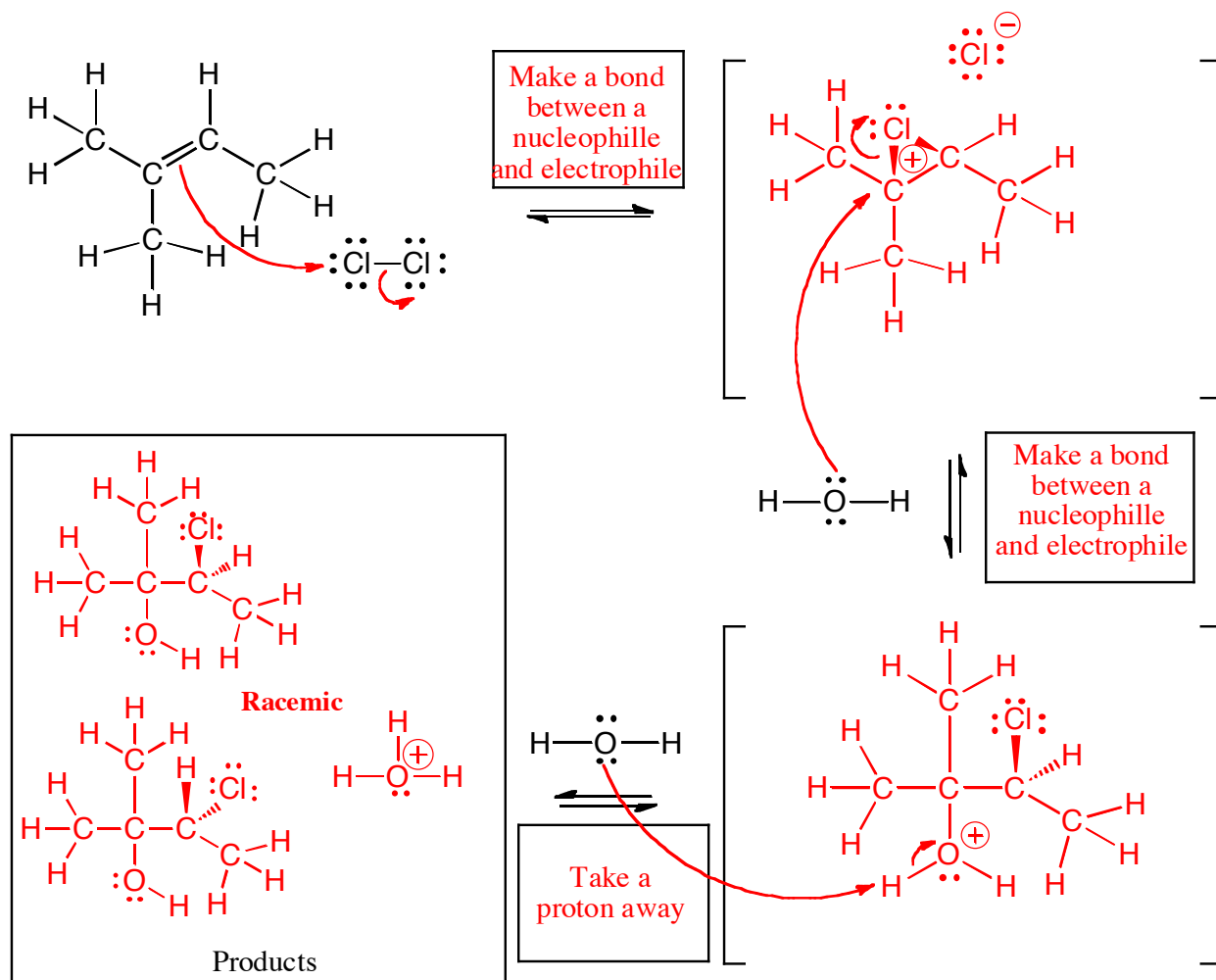


Homework 3
Organic Chemistry MCAT Review
Summer 2012
Brent Iverson

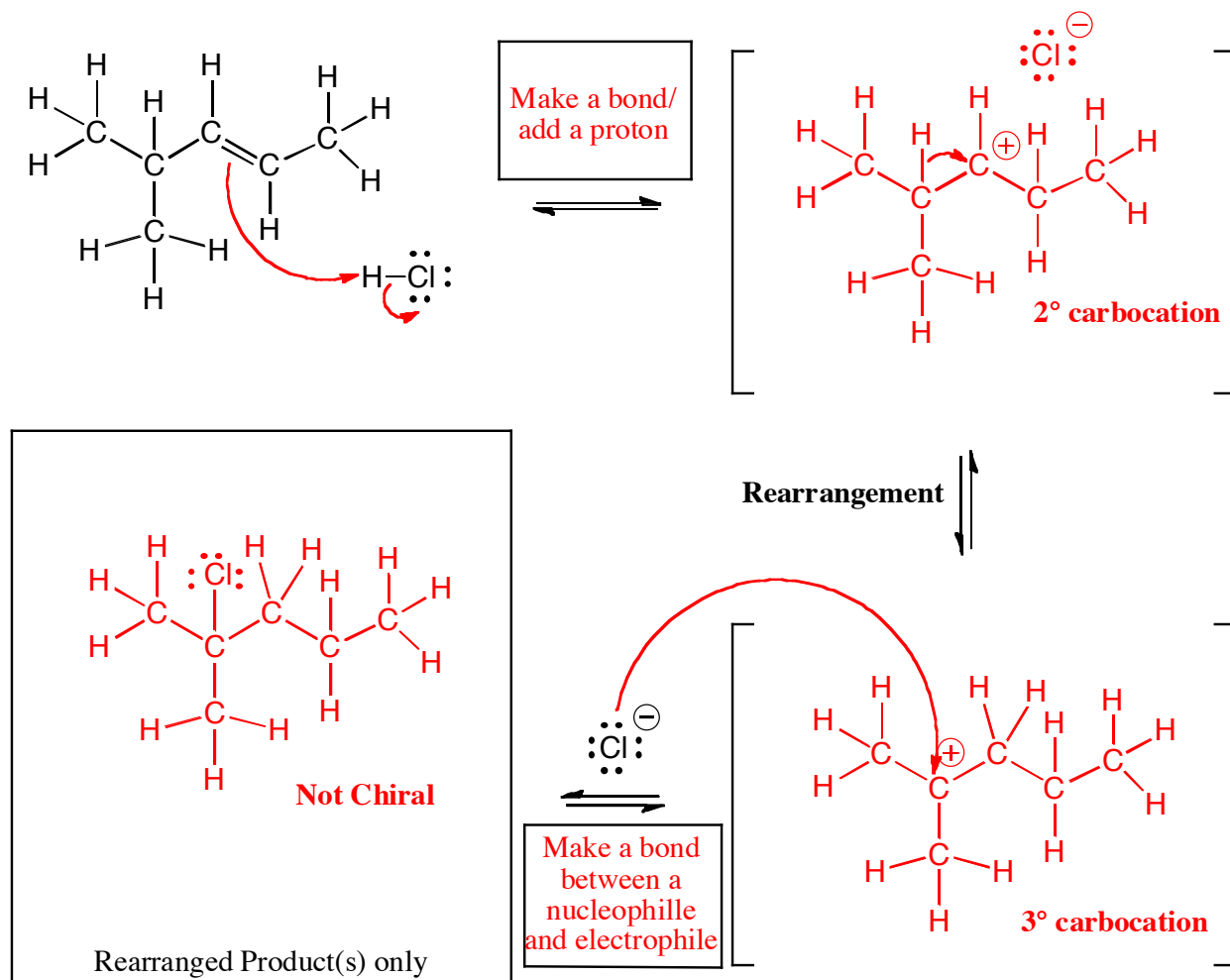
1. For the reaction of an alkene with water in the presence of Cl_2 , shown below, fill in the details of the mechanism. Draw the appropriate chemical structures and use an arrow to show how pairs of electrons are moved to make and break bonds during the reaction. For this question, you must draw all molecules produced in each step (yes, these equations need to be balanced!). Finally, fill in the boxes adjacent to the arrows with the type of step involved, such as "Make a bond" or "Take a proton away". MAKE SURE TO NOTICE THE QUESTIONS AT THE BOTTOM. If an intermediate or product is chiral, you only need to draw one enantiomer for this problem. For the product, you must draw both enantiomers and write "racemic" if appropriate.



During the reaction described by the above mechanism what happens to the pH of the solution The pH drops because acid (H_3O^+) is produced

Is this reaction catalytic in acid? No, acid is produced

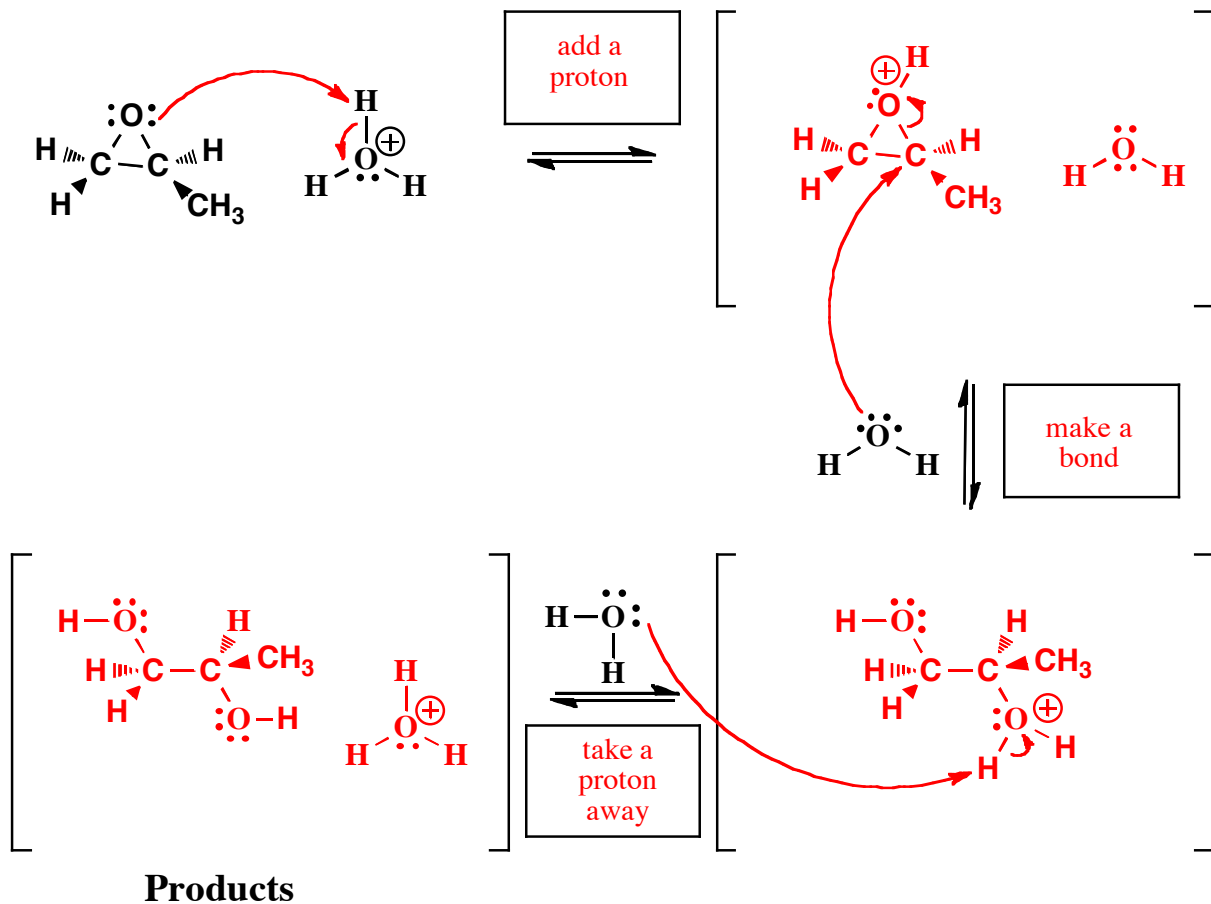
2. For the reaction of an alkene with HCl shown below, fill in the details of the mechanism FOR THE REARRANGEMENT REACTION ONLY. OTHER PRODUCTS WILL FORM, BUT WE ARE CONCERNED WITH THE REARRANGEMENT MECHANISM AND PRODUCT(S) ONLY. Draw the appropriate chemical structures and use an arrow to show how pairs of electrons are moved to make and break bonds during the reaction. For this question, you must draw all molecules produced in each step (yes, these equations need to be balanced!). Finally, fill in the boxes adjacent to the arrows with the type of step involved, such as "Make a bond" or "Take a proton away". MAKE SURE TO NOTICE THE QUESTIONS AT THE BOTTOM. If an intermediate or product is chiral, you only need to draw one enantiomer for this problem. For the product, you must draw both enantiomers and write "racemic" if appropriate.



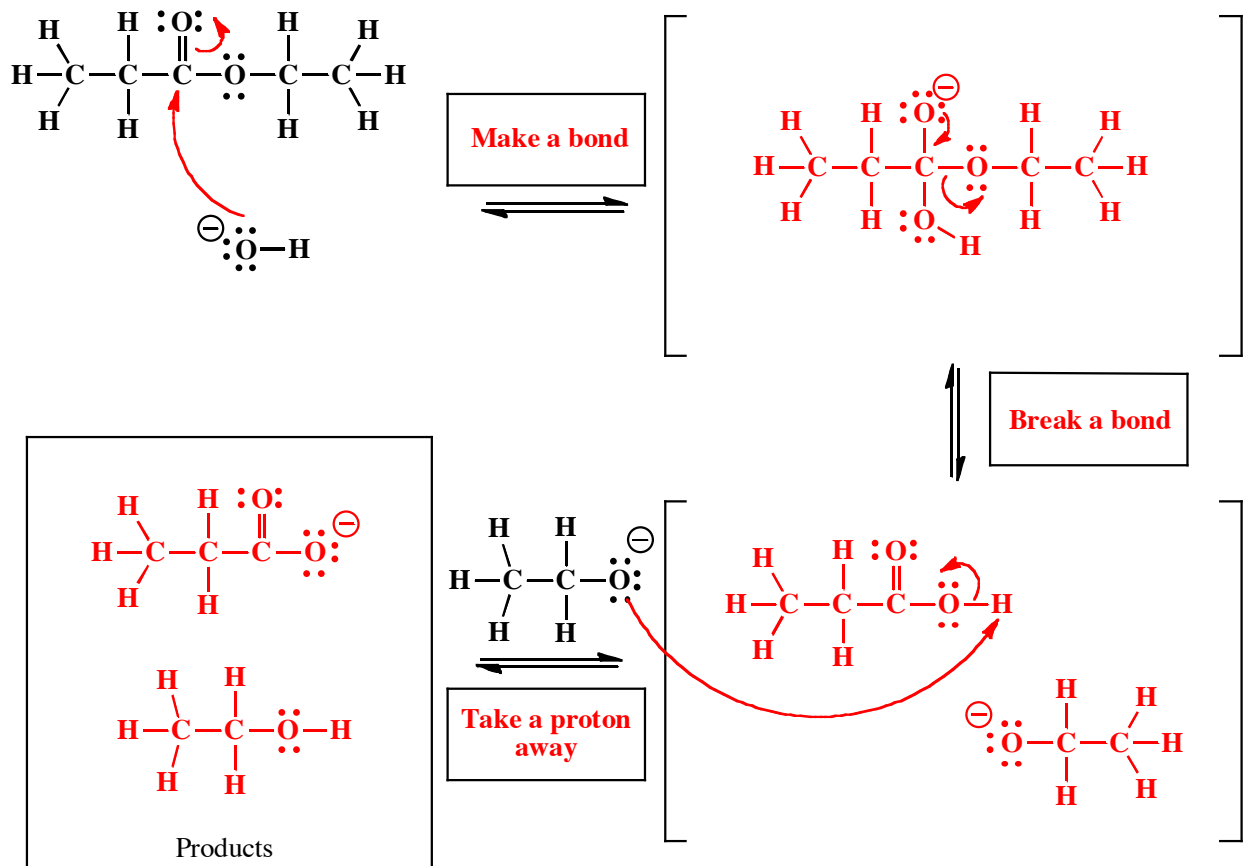
During the reaction described by the above mechanism, what happens to the pH of the solution? The pH increases because acid (HCl) is consumed

Is this reaction catalytic in acid? No, acid is consumed

3. For the following reaction, fill in the details of the mechanisms. Draw the appropriate chemical structures and use arrows to show how pairs of electrons are moved to make and break bonds during the reaction. Make sure to show all lone pairs and all formal charges. Indicate stereochemistry where appropriate. Draw **all** products of each step. **IF A RACEMIC MIXTURE OF INTERMEDIATES IS FORMED, YOU ONLY NEED TO DRAW ONE ENANTIOMER BUT WRITE RACEMIC. IF A RACEMIC MIXTURE OF PRODUCTS IS FORMED DRAW BOTH ENANTIOMER PRODUCTS AND WRITE RACEMIC!** In the boxes provided next to the arrows, state what kind of mechanistic element is being described, i.e. make a bond, etc.



4. Complete the mechanism for the following **base promoted ester hydrolysis** reaction. **Be sure to show arrows to indicate movement of all electrons, write all lone pairs, all formal charges, and all the products for each step.** Remember, I said all the products for each step. **IF A NEW CHIRAL CENTER IS CREATED IN AN INTERMEDIATE OR THE PRODUCTS, MARK IT WITH AN ASTERISK** and **WRITE RACEMIC IF RELEVANT**.



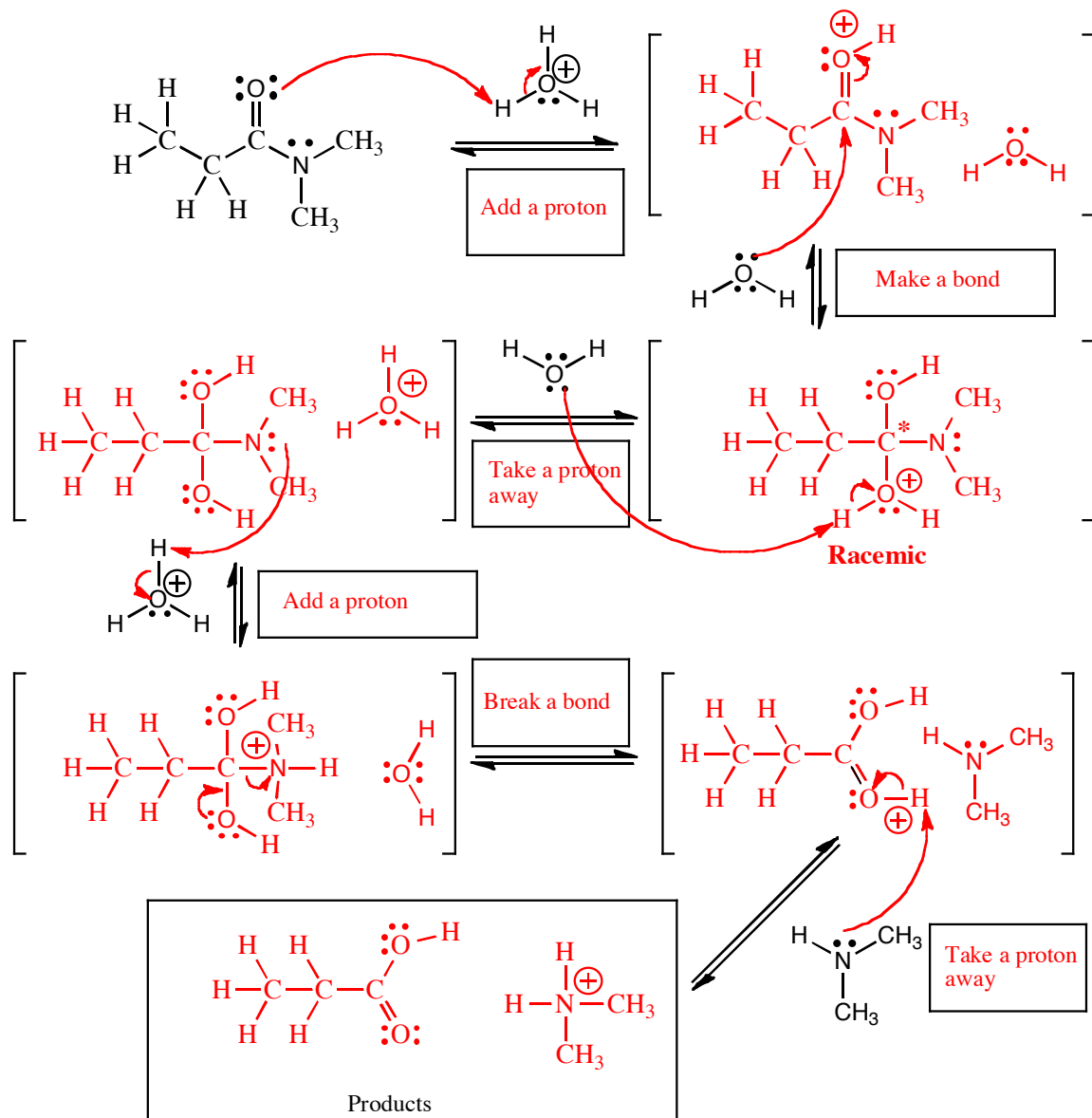
In the boxes provided adjacent to the first two sets of arrows, write which of the four basic mechanistic elements are involved (i.e. "Make a bond", "Add a proton", etc).

NOTICE THESE

In one sentence explain why this reaction is referred to as base "promoted" rather than base "catalyzed".

The reaction requires HO⁻ in the first step, but the HO⁻ is consumed during the reaction leaving a carboxylate (a much weaker base) as the negatively charged product.

5. Complete the mechanism for the following **acid promoted amide hydrolysis** reaction. **Be sure to show arrows to indicate movement of all electrons, write all lone pairs, all formal charges, and all the products for each step.** Remember, I said all the products for each step. **IF A NEW CHIRAL CENTER IS CREATED IN AN INTERMEDIATE OR THE PRODUCTS, MARK IT WITH AN ASTERISK AND WRITE RACEMIC IF RELEVANT.**



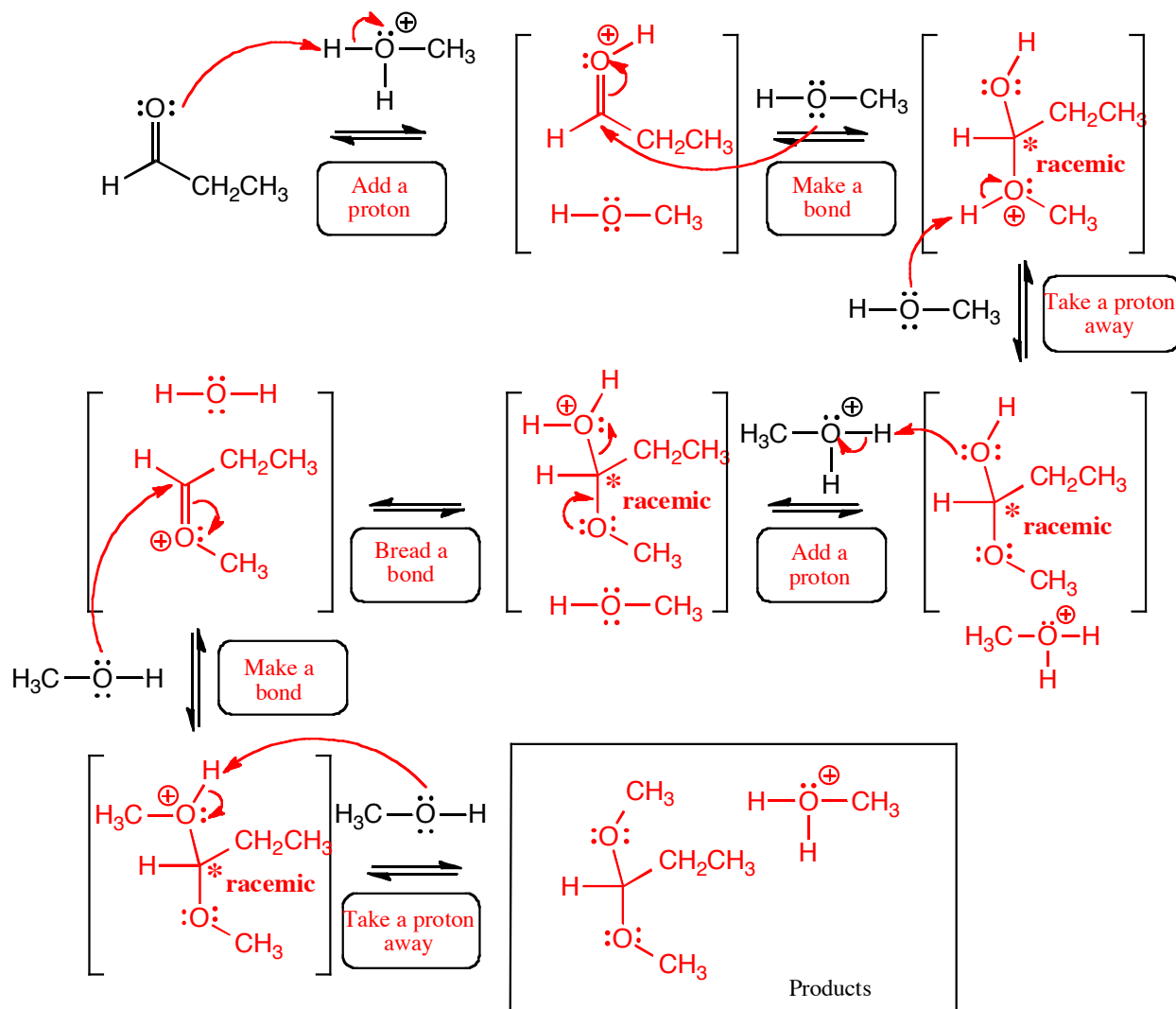
In the boxes provided adjacent to the first two sets of arrows, write which of the four basic mechanistic elements are involved (i.e. "Make a bond", "Add a proton", etc).

NOTICE THESE

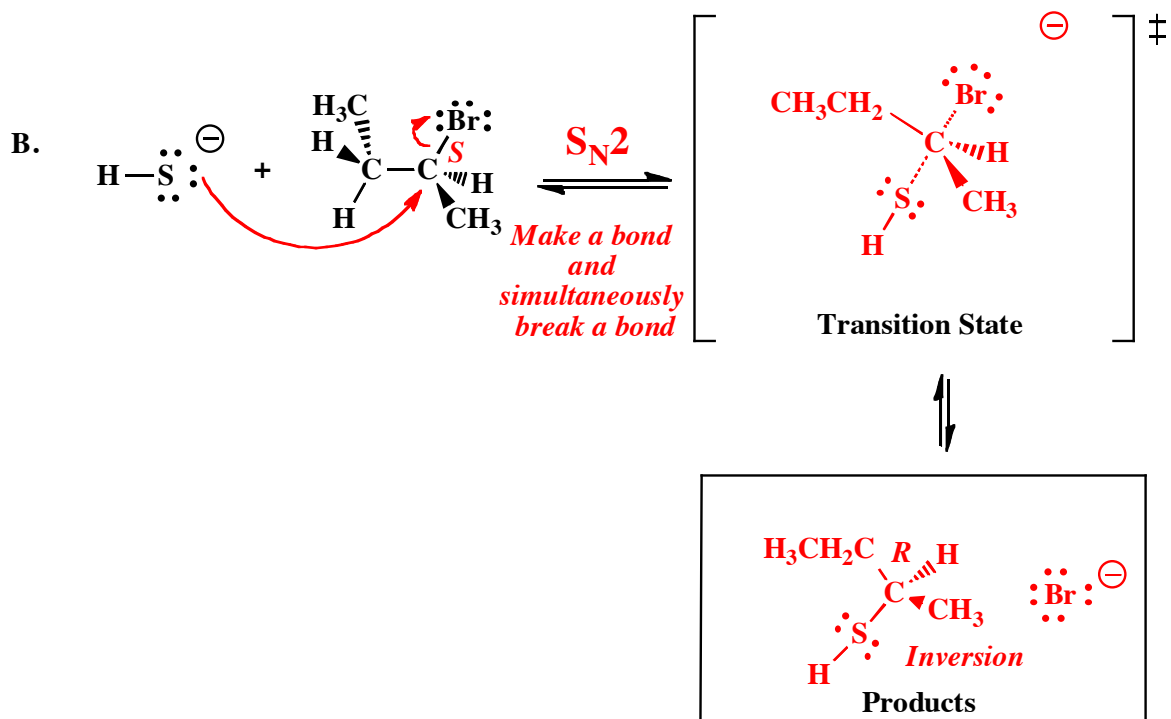
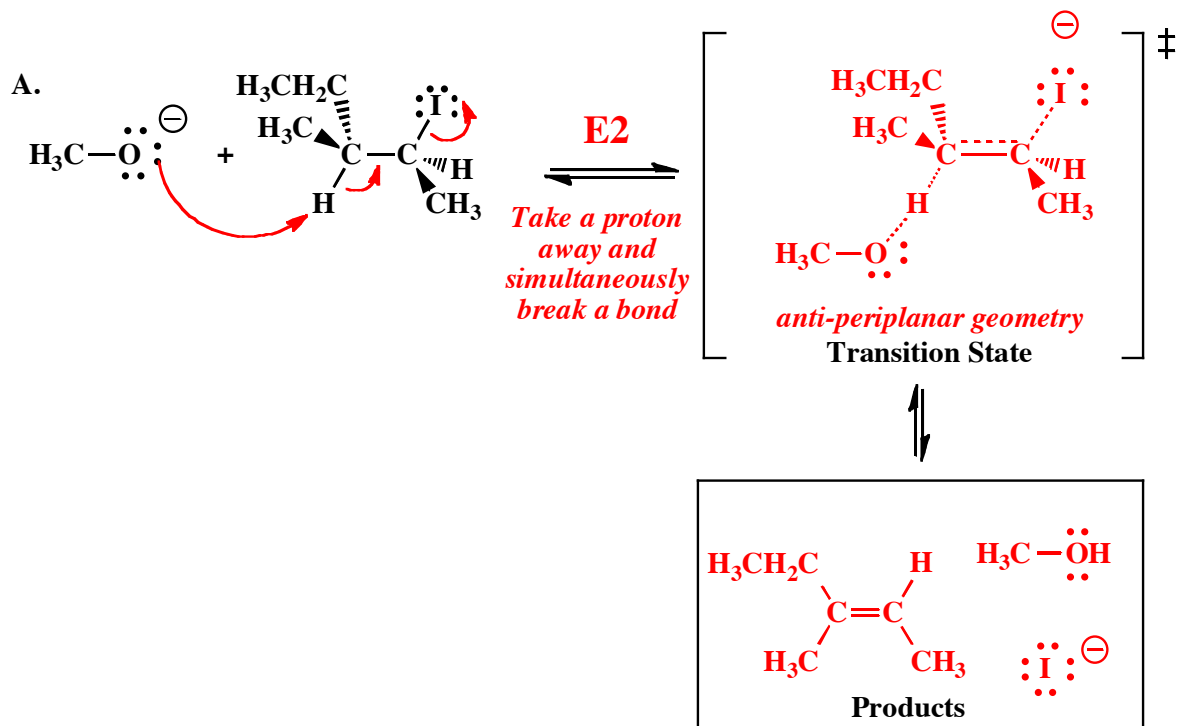
In one sentence explain why this reaction is referred to as acid "promoted" rather than acid "catalyzed".

The reaction requires acid in the first step, but the proton is consumed during the reaction leaving an ammonium ion (a much weaker acid) as the protonated product.

6. Complete the following mechanism for acetal formation. Make sure to show all lone pairs, all formal charges and use arrows to indicate the flow of all electrons. You must draw all products that are made in each step. Fill in each box with the appropriate phrase such as "Make a bond", etc. This should look familiar, as it is identical to the mechanism sheet handed out in class. **Put an asterisk (*) next to any chiral center and write "racemic" wherever appropriate.**



7. For each set of reagents below, draw the key transition state that occurs during the indicated reactions and then the product. Use dotted lines to indicate bonds that are in the process of being broken or made. Write all lone pairs of electrons any formal charges that you think are important. On the starting structures, draw all appropriate arrows to indicate the flow of electrons. Make sure to draw all the products that are produced including stereochemistry where appropriate.



8. The following reactions all involve chemistry of alkyl halides. Fill in the box above the arrow with the mechanism that will be followed (S_N2 , E2, etc.). Then draw only the predominant product or products and please remember that you must draw the correct stereoisomers. For $S_N1/E1$ reactions you must draw all significant products (including all stereoisomers).

