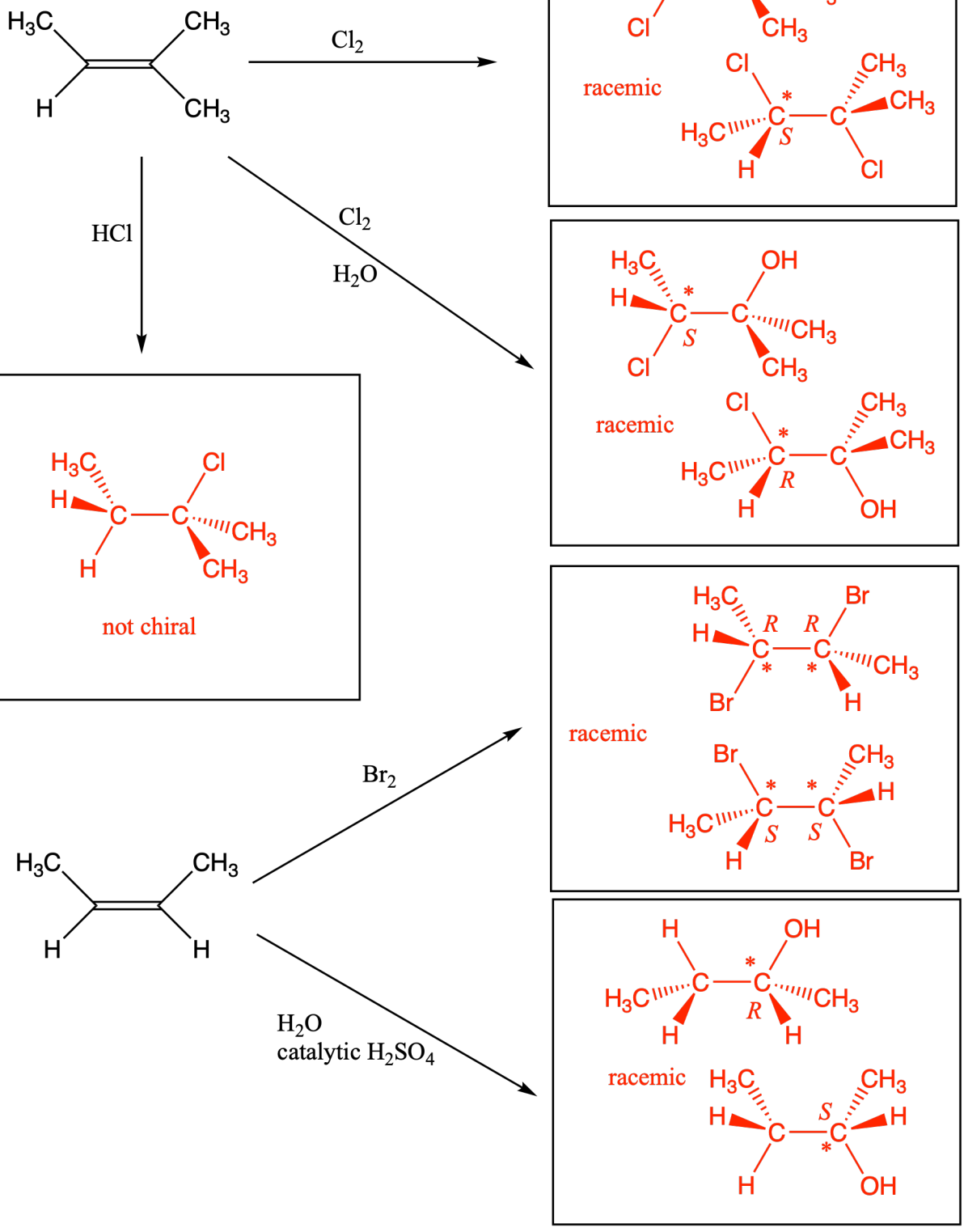
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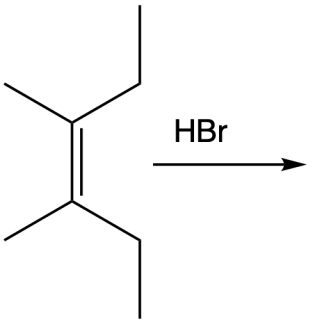
Chemistry 320M/328M
Dr. Brent Iverson
7th Homework
October 14, 2026

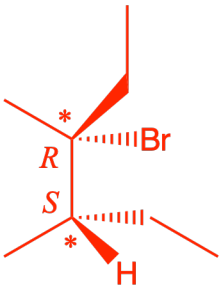
Please print the first three letters of your last name in the three boxes

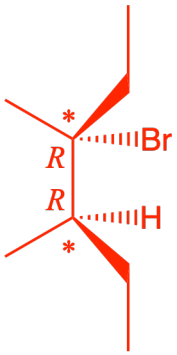
1. For the following reactions, fill in the boxes with the predominant product or products. You must indicate stereochemistry with wedges and dashes. If a racemic mixture is created, you must write "racemic" under the structures.



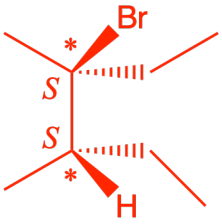
2. For the following reaction, fill in the box with the predominant product or products. You must indicate stereochemistry with wedges and dashes. If a racemic mixture is created, you must write "racemic" under the structures.

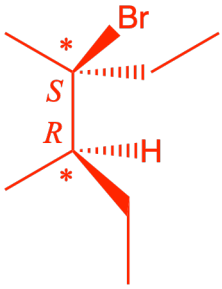






Racemic





The mixed stereochemistry of HBr addition (the H and Br can add from either the same or opposite faces of the double bond) mean that you get both *cis* and *trans* products. Keep in mind you are creating two chiral centers, so there are 4 possibilities total. It is important for you to be systematic in the way you draw product stereoisomers.

Let's try something new. It will take you about 30 minutes, but I think it will help tie all the pieces together in your mind in time to help you crush the second midterm. **Consider the reaction on the previous page (Problem 2). I would like you to write a detailed narrative of exactly how each of the products you drew is formed. Describe what is reacting, the intermediates that are created along the way and how each product forms. Write like you are narrating a movie.** The goal is to have you observe the reaction in your mind's eye and think through the mechanism details. Uncover features of the process you might have missed until now. Do not cheat yourself and use AI. Do this on your own, **in your own handwriting** (no pasting AI generated text allowed!!). I will start you off:

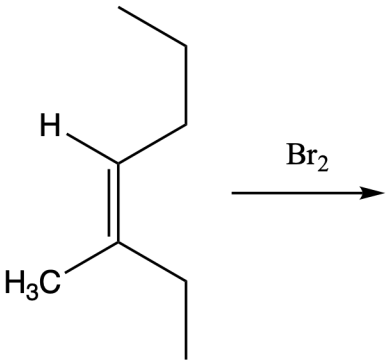
The first thing that happens when (*Z*)-3,4-dimethyl-3-hexene reacts with HBr is that the pi bond acts as an electron source and we add a proton to give a carbocation and a bromide anion. If the proton comes from above the alkene, and reacts with the lower carbon, an "*S*" chiral center will be created. In the next step of the reaction of this carbocation intermediate, the bromide anion reacts as a nucleophile and could come from underneath the molecule to make a bond with the carbocation electrophile and that would create the *R,S* product I drew in the top left-hand corner. If the bromide anion attacks the carbocation from above it would create the *S,S* product I drew in the bottom left corner.

If the original proton is added to the bottom carbon atom of the double bond from the bottom of the alkene, that would create an "*R*" chiral center. If the bromide anion nucleophile attacks the carbocation electrophile to make a bond from underneath the molecule, it will create the *R,R* product drawn in the upper right corner. If the bromide anion attacks from above, it will create the *S,R* product shown in the bottom right corner.

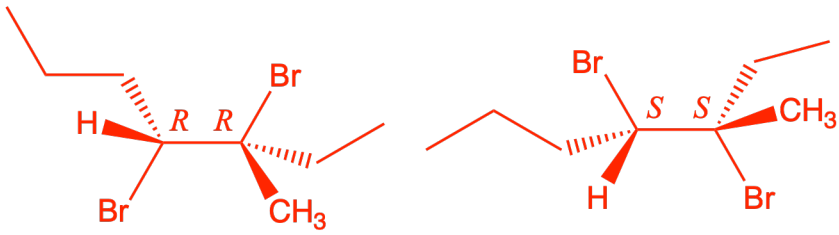
Because of symmetry in the starting alkene, if the first protonation happens on the upper carbon, you will get the same four products! You can check this for yourself by actually making them and comparing to the products made as described above. Again, it is the symmetry of the starting alkene that allows this.

If we lose that symmetry, for example starting with (*Z*)-3,4-dimethyl-3-octane, the products formed from protonating the lower and upper carbon atoms would be different, meaning 8 products!

3. For the following reaction, fill in the box with the predominant product or products. You must indicate stereochemistry with wedges and dashes. If a racemic mixture is created, you must write "racemic" under the structures.



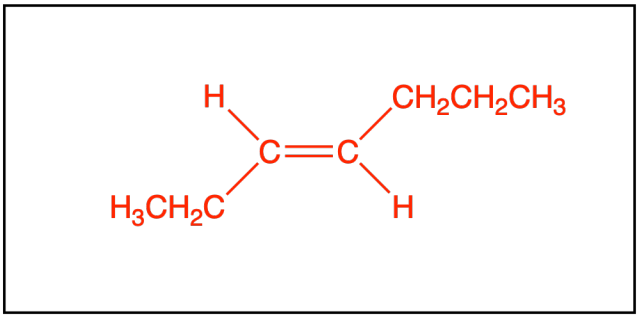
anti addition so Br atoms only add *trans*



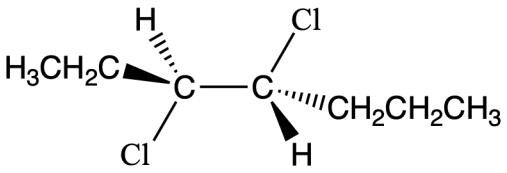
Racemic

There is only one constitutional isomer here because the Br atoms add to both C atoms of the double bond. The anti addition gives only the two enantiomers shown.

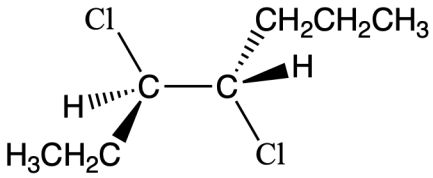
4. For the following reactions, fill in the boxes with the starting material that leads to the predominant product or products.

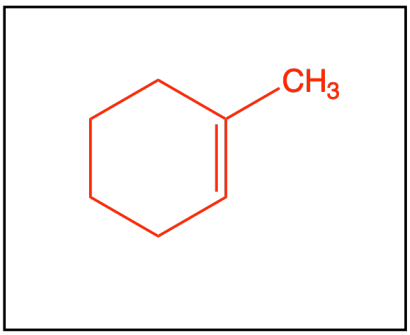


Cl_2

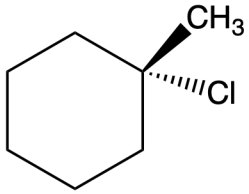


racemic



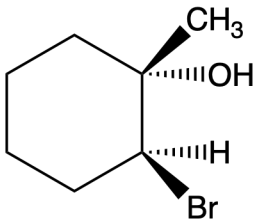


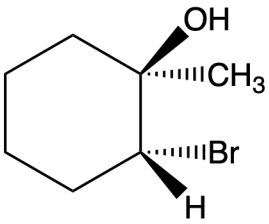
HCl



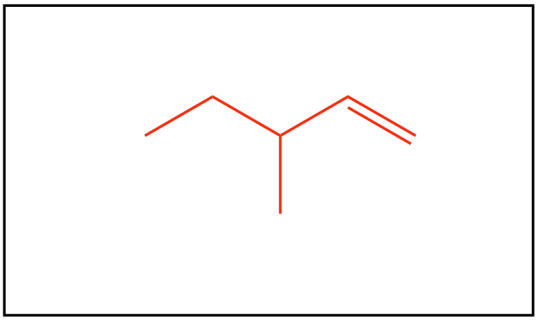
Not chiral

Br_2
H_2O

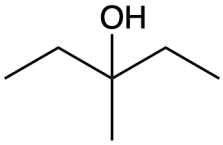


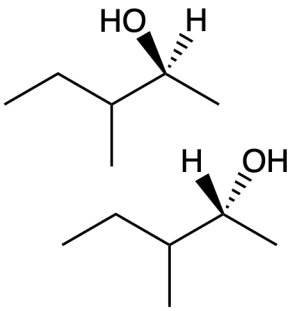


Racemic



H_2O
catalytic H_2SO_4

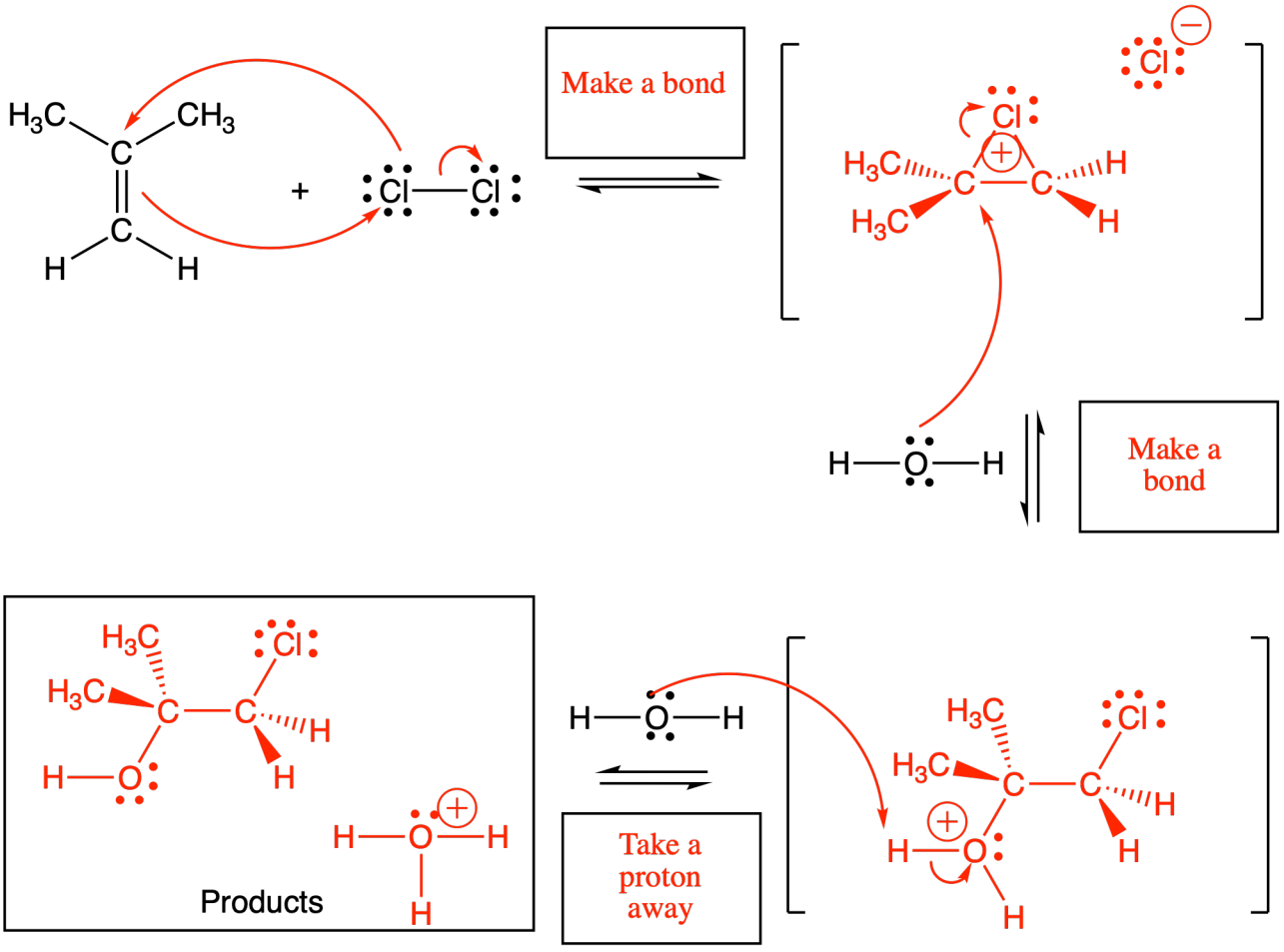




racemic

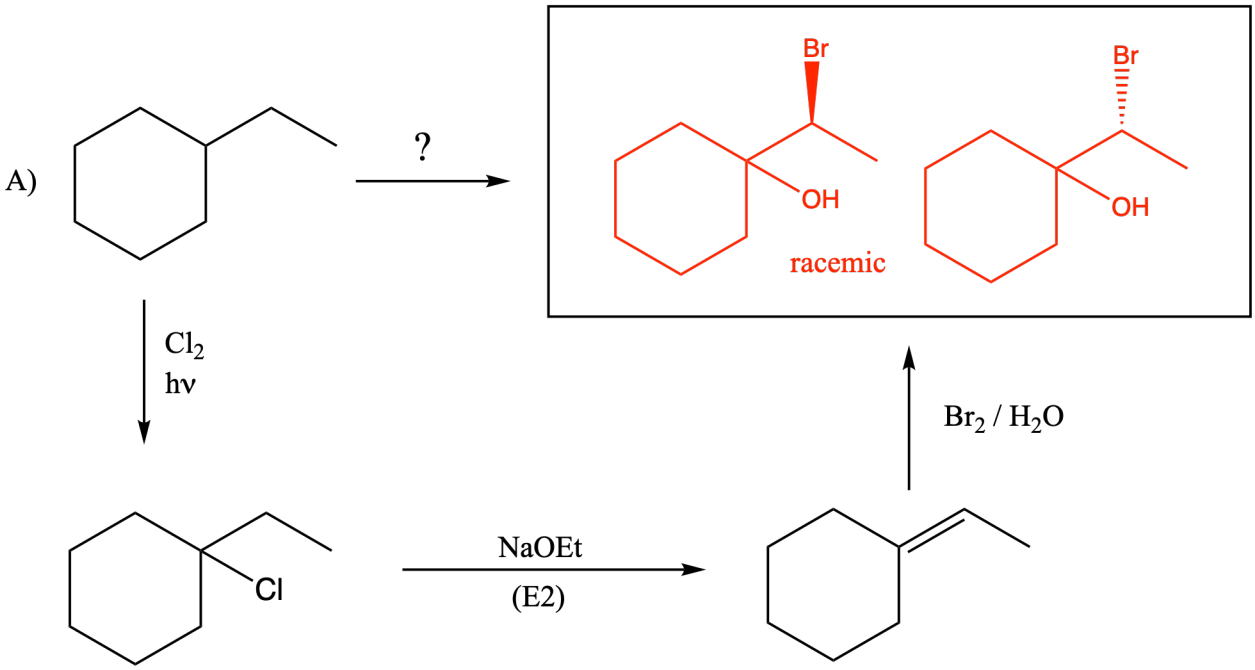
5. Read these directions carefully. **For the reaction of 3-methyl-1-propene with Cl_2 and H_2O shown below, fill in the details of the mechanism. Draw the appropriate chemical structures and use an arrow to show how pairs of electrons are moved to make and break bonds during the reaction. Be sure to write all lone pairs of electrons and all formal charges. Finally, in the boxes provided by the arrows, write which kind of mechanistic element is being indicated, such as "make a bond", "add a proton", etc.**

Alkene Hydrohalogenation

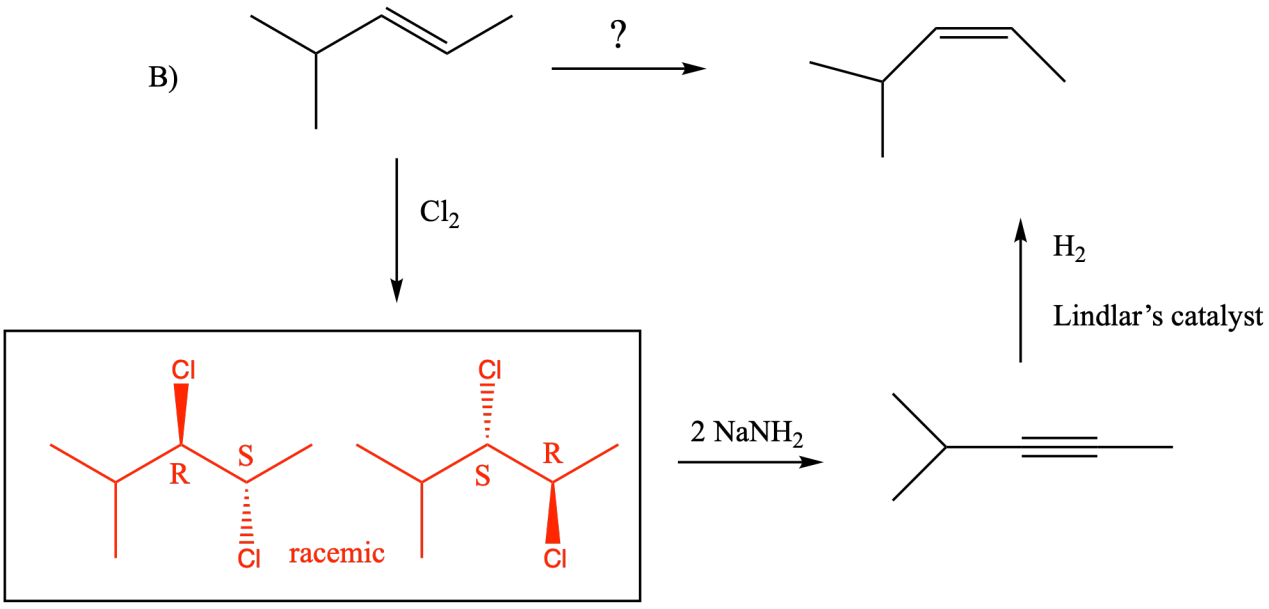


6. For the following synthesis schemes, fill in the missing molecules. Note, you do not understand all of this chemistry yet, but soon you will and then you will be responsible for the entire sequence of synthetic reactions! Even if you have not seen all the chemistry, please take a moment to see what kind of transformations are occuring in each step of the synthesis.

A)



B)



7. For the following synthesis scheme, fill in the missing molecules. Note, you do not understand all of this chemistry yet, but soon you will and then you will be responsible for the entire sequence of synthetic reactions! Even if you have not seen all the chemistry, please take a moment to see what kind of transformations are occuring in each step of the synthesis.

