NAME (Print): _____

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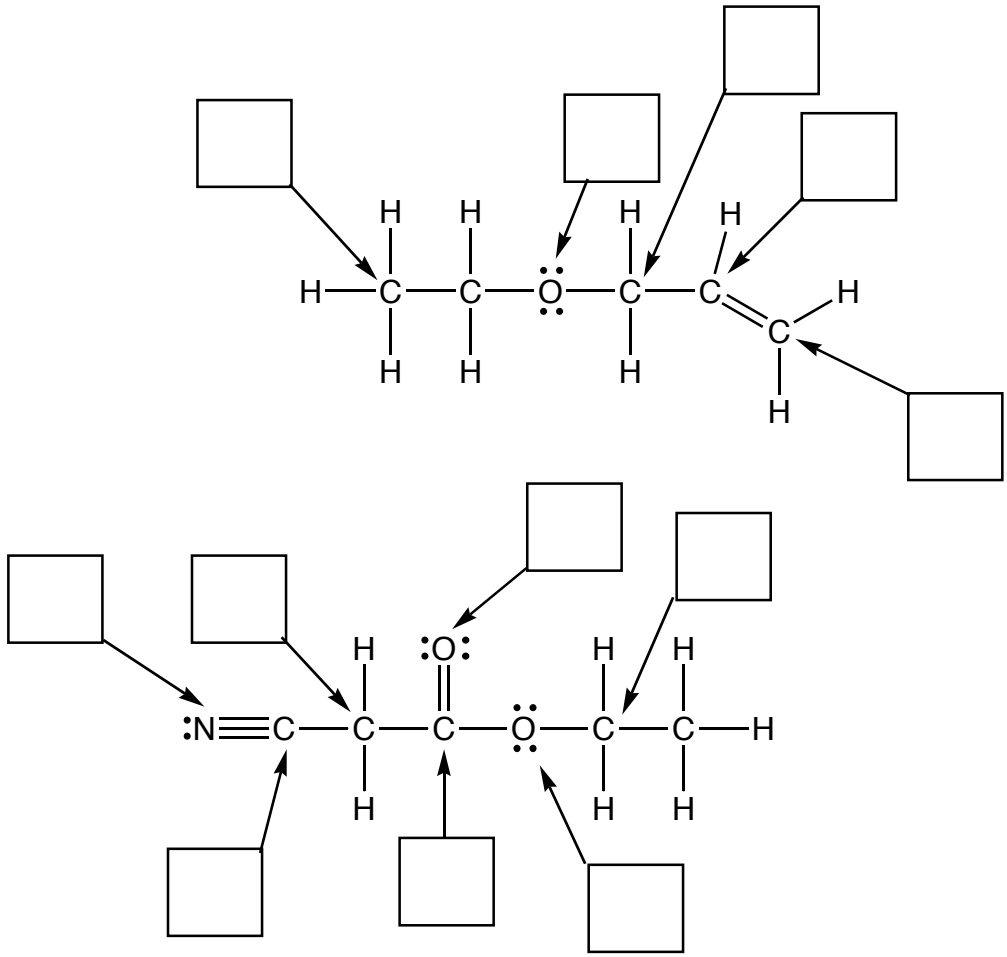
Chemistry 310N
Dr. Brent Iverson
Practice Homework
February 13, 2008

Do not turn this in. It is intended as a helpful review.

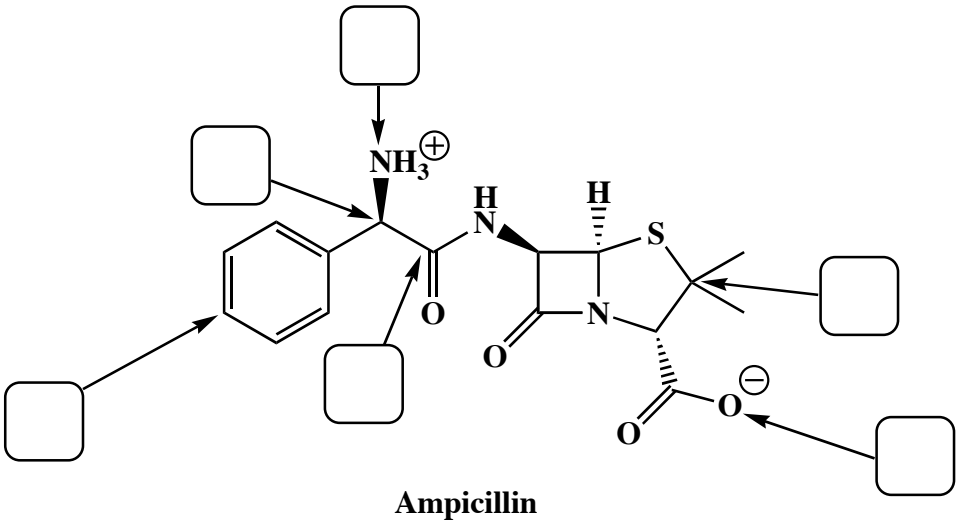
We have noticed that some of you are having trouble thinking about organic structures in terms of hybridized atoms and bonding as being derived from the overlap of atomic orbitals. *These are topics that must be mastered before leaving organic chemistry.* As a review, the following pages contain several problems that test knowledge of hybridization and bonding in organic molecules. If you have trouble with these, ask questions at office hours or recitation sections. The answers will be posted Friday. **There will be one or two problems along these lines on the midterm, so that I can know once and for all that these concepts have been mastered by the entire class. The rest of the midterm will be concerned with new material.**

Note also that you are responsible for ketone and aldehyde nomenclature. We did not go over it in class because the book explains it as well as I could in lecture. The end of this problem set has some nomenclature problems to help you learn the rules.

1. In the boxes provided, write the hybridization state of the atom indicated by the arrow.



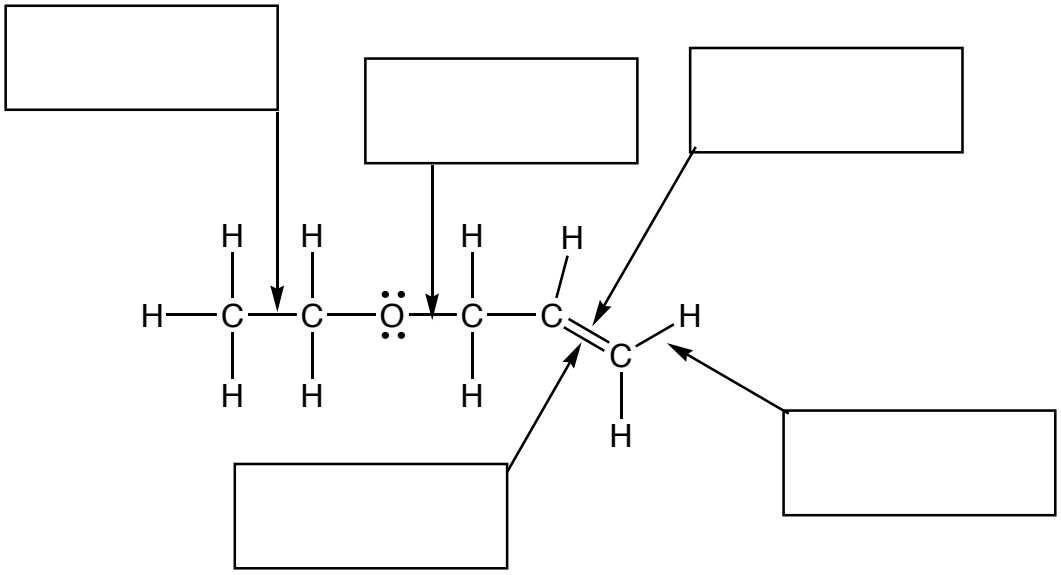
2. (2 pt each) A) For each atom indicated, state the hybridization state in the box provided.

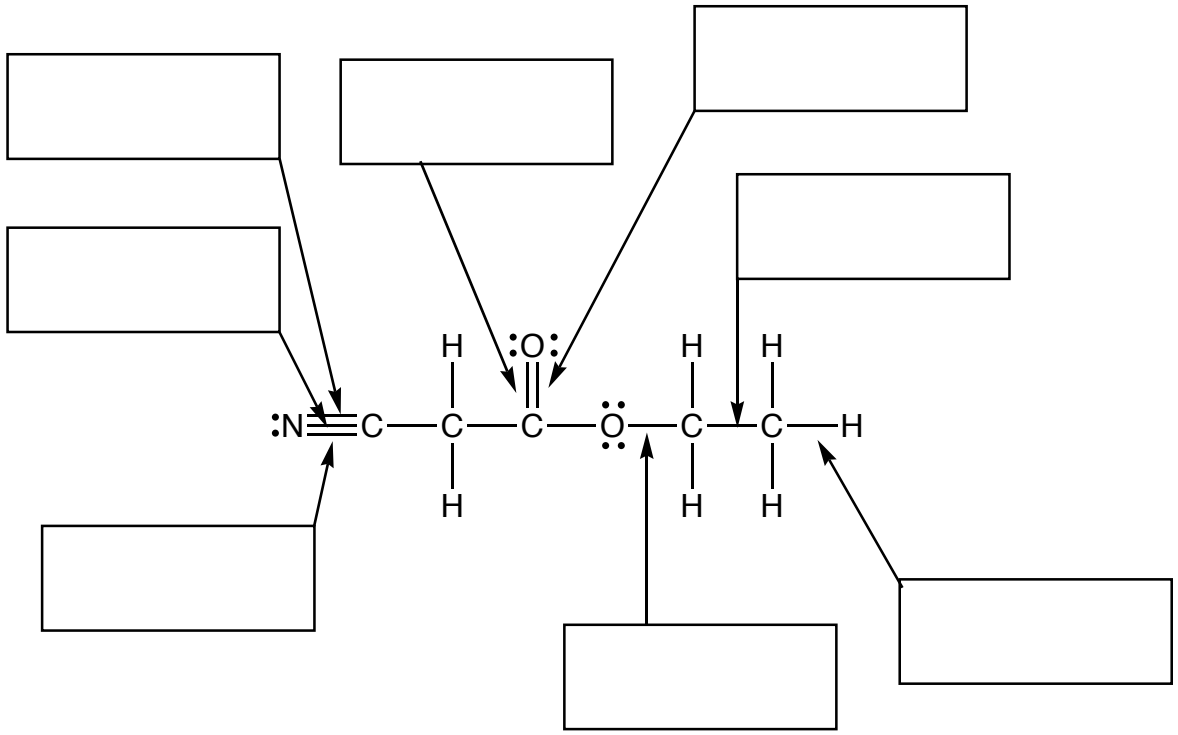


Ampicillin

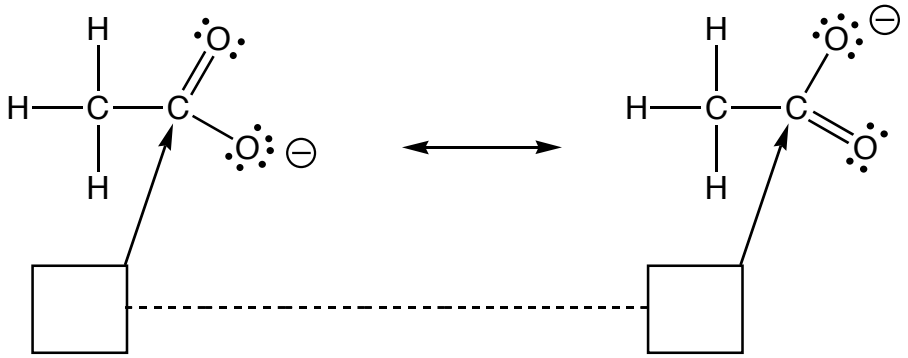
B) (1 pt. each) On the above structure, put an asterisk next to each chiral center.

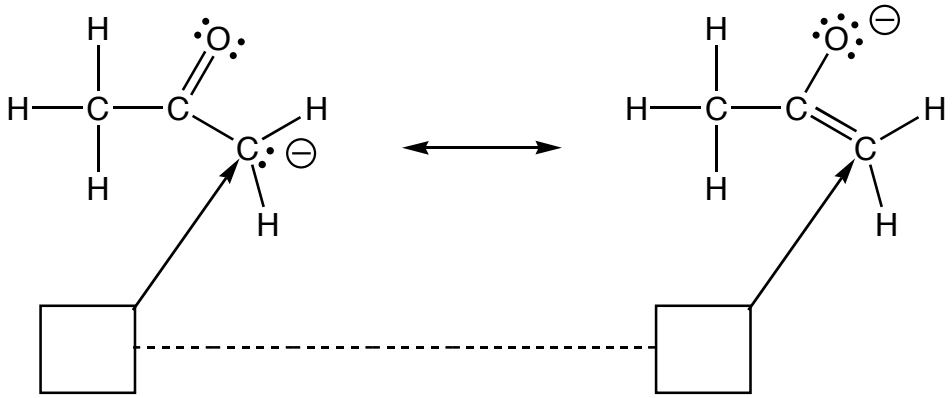
3. On the following structures, describe the bonds indicated in terms of overlap between hybrid orbitals (the valence bond approach). For example, answers might be $\sigma_{Csp^2\text{-}Csp^3}$ or $\pi_{C2p\text{-}C2p}$.

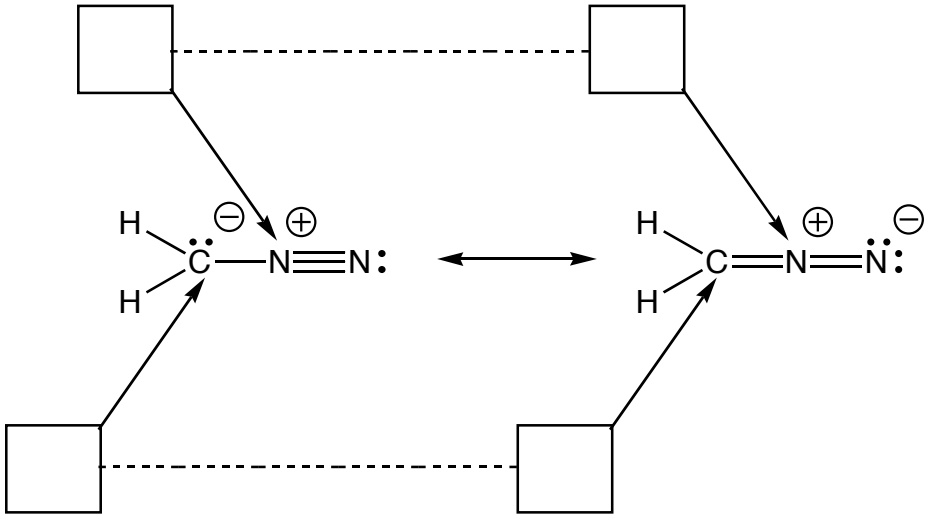




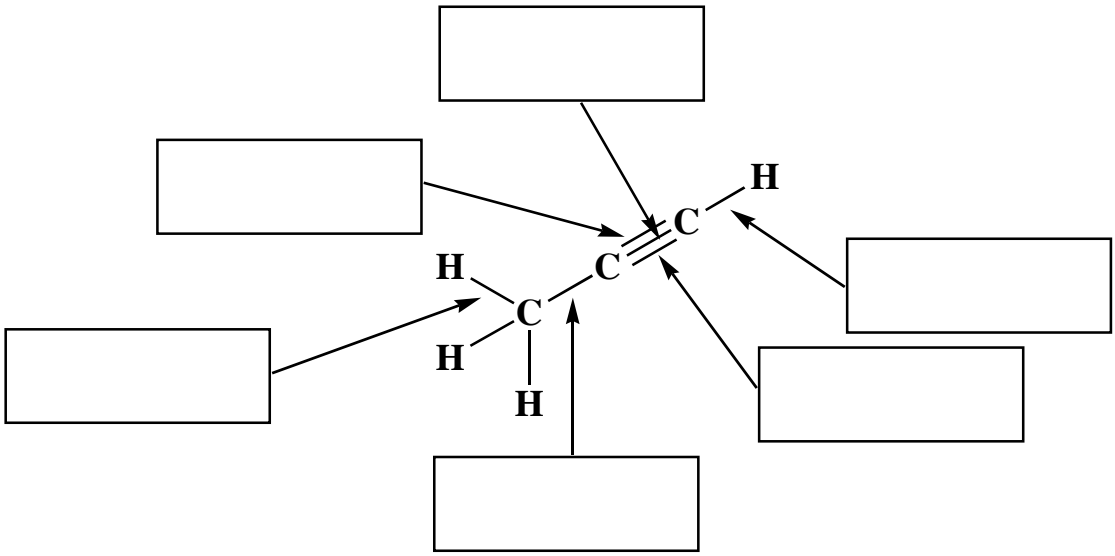
4. Hybridization can be particulary difficult to determine in some molecules represented by multible contributing structures. For the folowing molecules, two resonance structures are required to describe accurately the electronic/charge distribution. In the boxes provided, state the hybridization state of the indicated atoms.

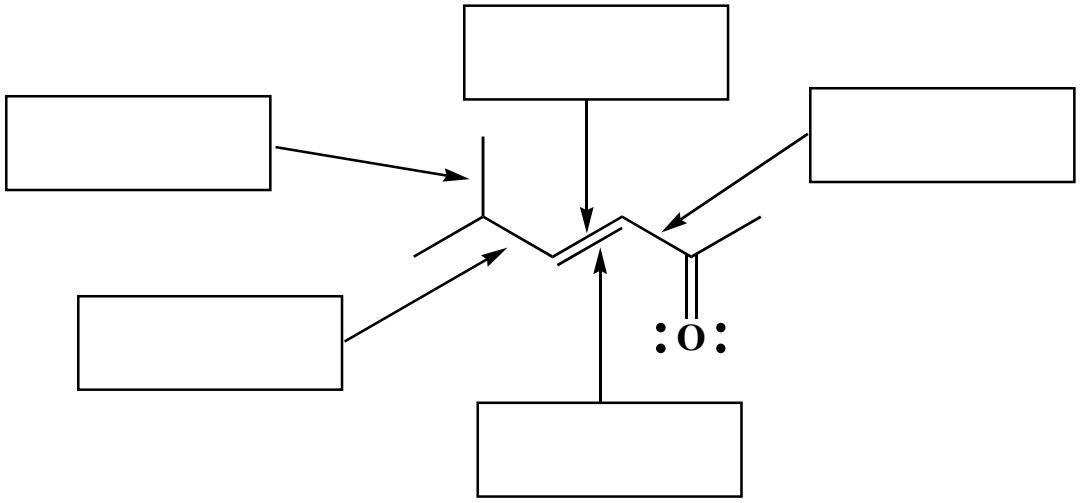






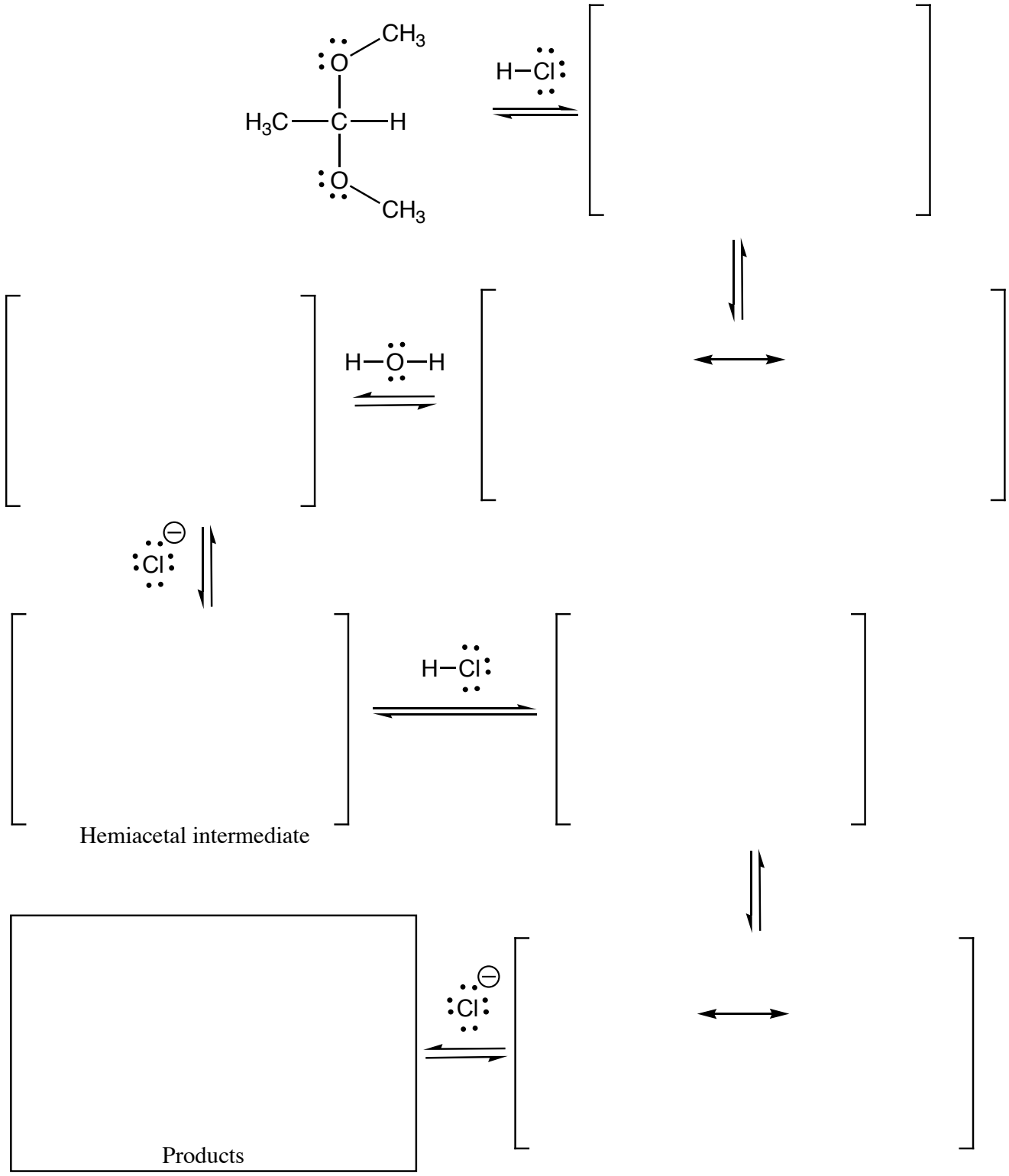
5. (2 pts each) Describe each bond indicated with an arrow as the overlap of orbitals. For example, an answer might be $\sigma_{Csp^3\text{-}Csp^3}$.





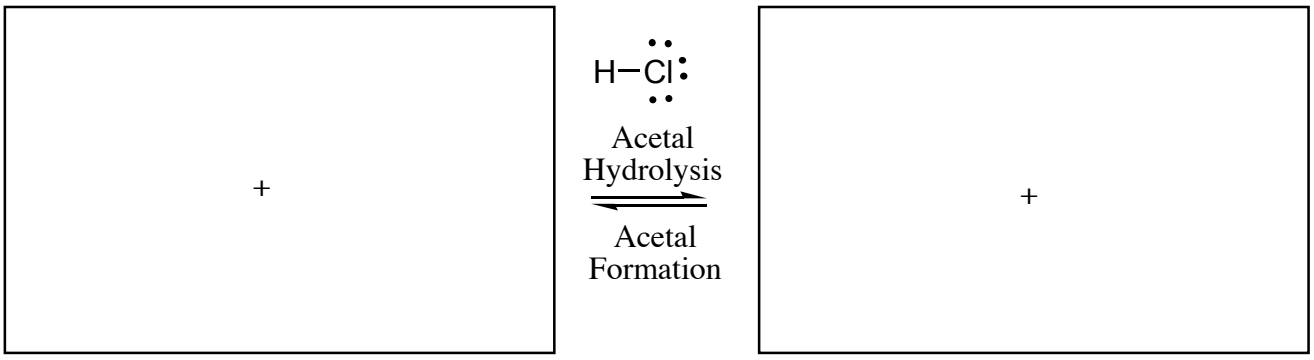
6. For the following reaction, fill in the details of the mechanism. Draw the appropriate chemical structures and use an arrow to show how pairs of electrons are moved to make and break bonds during the reaction. Make sure to show all lone pairs and all formal charges. Draw all products of each step. ***Remember that each step is one of the four mechanistic elements, all you have to do is decide which one needs to be used at any one time!!***

Acid Catalyzed Acetal Hydrolysis



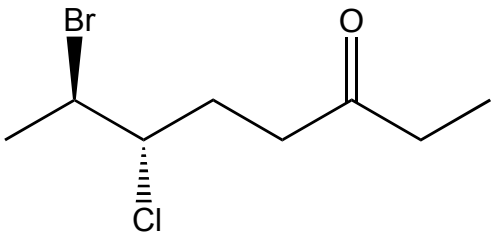
Acid catalyzed acetal hydrolysis continued.

Now write an equation that describes the overall process for the mechanism you just finished.



You have not seen the previous mechanism…….well, not exactly. It is the hydrolysis of an acetal, which is exactly the reverse of acid-catalyzed acetal formation as shown in the above equilibrium. Now, **compare the intermediates you drew on the preceding page to the intermediates we drew in class for the acid catalyzed acetal hydrolysis mechanism. THEY ARE EXACTLY THE SAME BUT IN REVERSE ORDER!!! This is the principle of microscopic reversibility. A mechanism proceeds along the same mechanism in both directions of an equilibrium. What we are hoping is that you were able to "figure out" the acetal hydrolysis mechanism as being the combination of the four mechanistic elements in an order that makes sense to you. If so, congratulations, you are officially catching the wave!!!! Figuring out a new mechanism you have not explicitly seen means you understand, as opposed to memorize, organic chemistry. Cowabromide!!**

7. On the line provided, write an acceptable IUPAC name for the following molecules.



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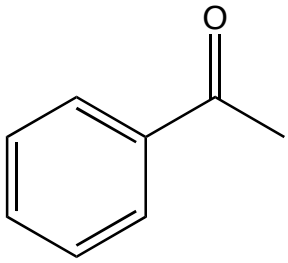

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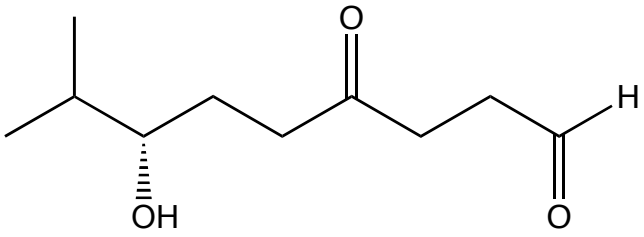

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