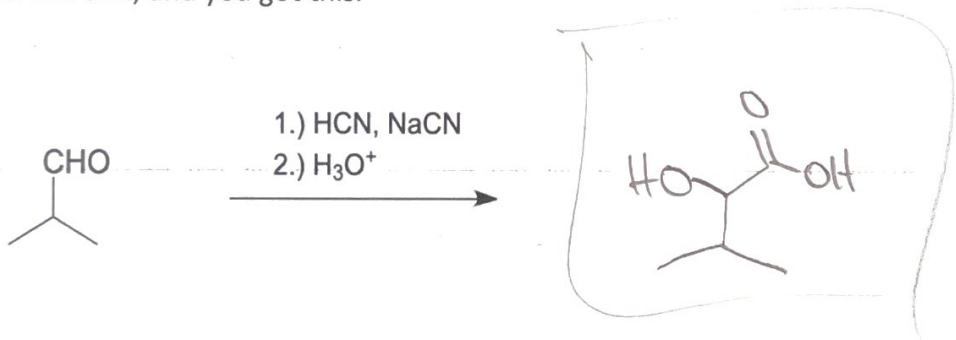
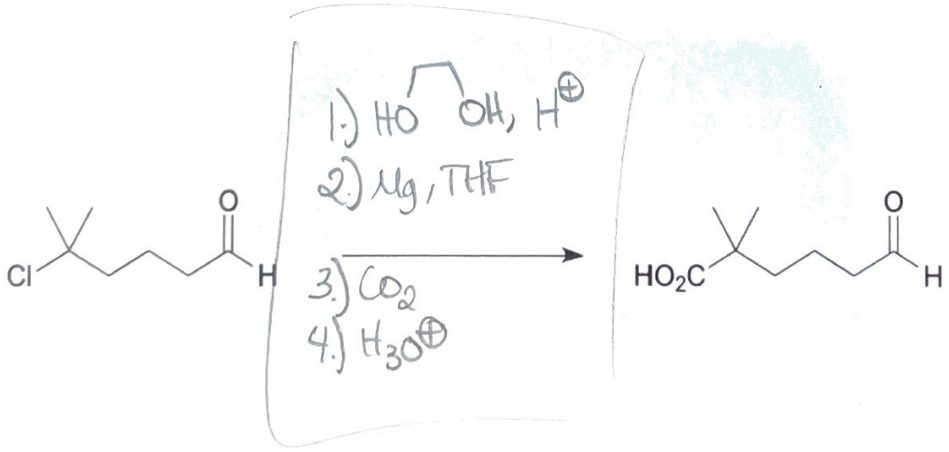
Carboxylic Acids: Rxn + Mechanism Practice with Carboxylic Acids

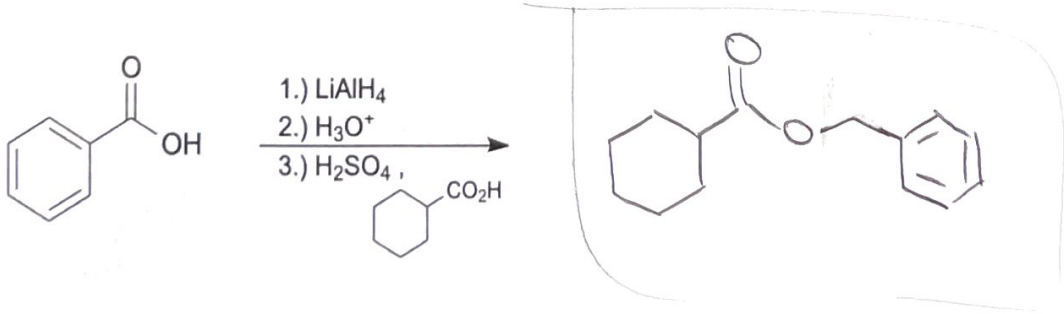
Okay, gang. Now that we've got our foot in the carboxylic acid-door, we're going to see what other chemistry we can do with this functional group. This is the one and only worksheet for this section, so it contains everything related to carboxylic acids.

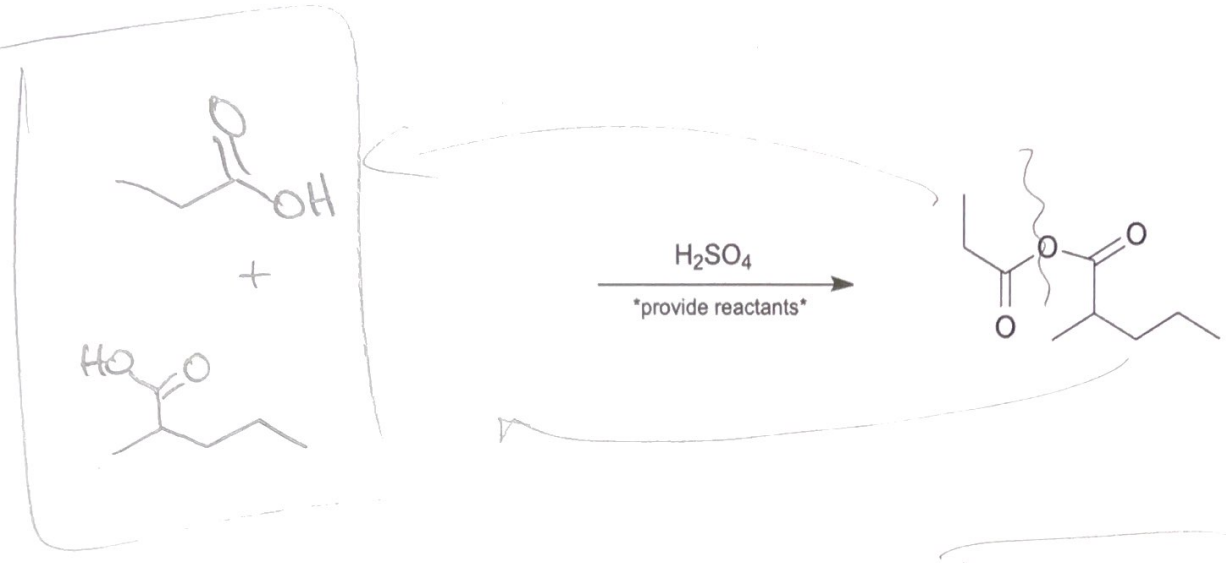
There is a concept question about acidity, a bunch of complete the reaction/fill in the reagent type questions, a mechanism, and then (at the end) some straight forward ester/amide/acid halide/acid anhydride formation mechanisms that you can do or feel free to skip.

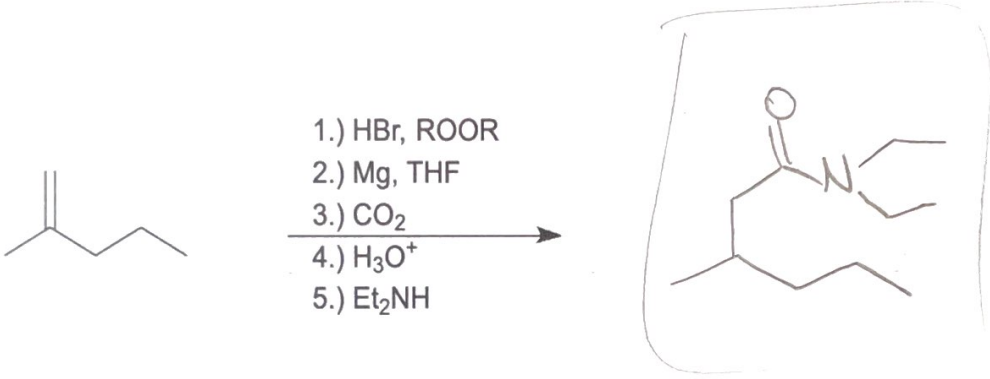
1. To kick things off, let's tackle some problems where you predict the major organic product/fill in the reagent/provide the reactant. You're seasoned organic veterans; you know the drill, and you got this.

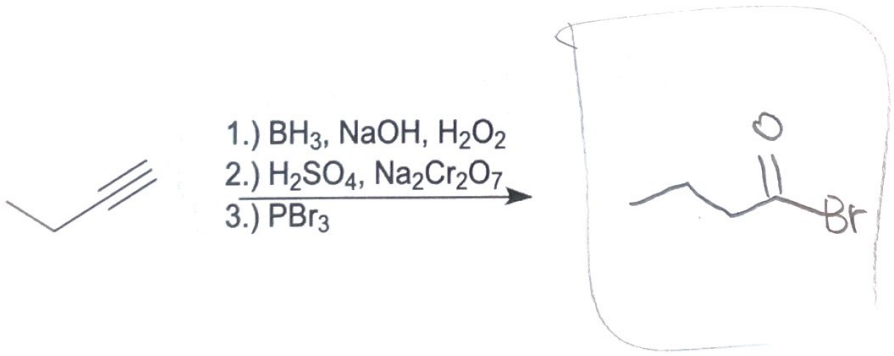


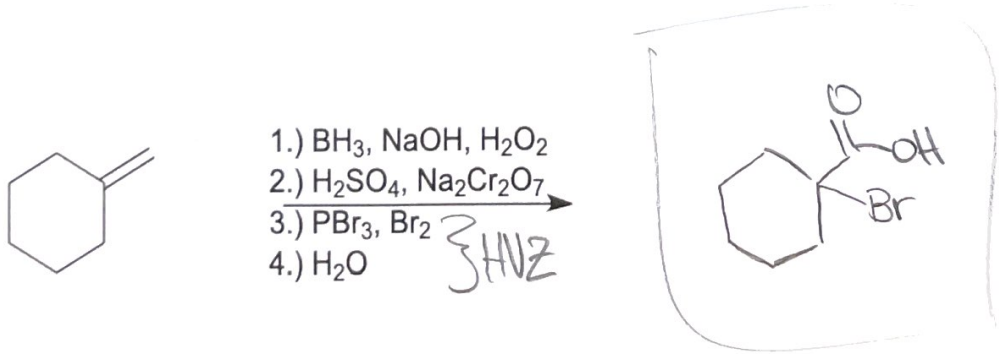





OH
+
HO
O
H_2SO_4
provide reactants
O
O
O
O

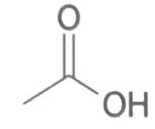

1.) HBr, ROOR
2.) Mg, THF
3.) CO_2
4.) H_3O^+
5.) Et_2NH
O
N


1.) BH_3, NaOH, H_2O_2
2.) H_2SO_4, $Na_2Cr_2O_7$
3.) PBr_3
O
Br

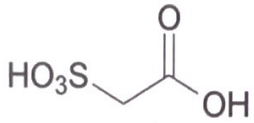

1.) BH_3, NaOH, H_2O_2
2.) H_2SO_4, $Na_2Cr_2O_7$
3.) PBr_3, Br_2
4.) H_2O
3 HVZ
O
OH
Br

2. Okay, gang. For question #2, I have a quick acidity ranking question (part a), and then part b rounds it out with a mechanism that lets us relive our ketone/aldehyde glory days.

   a. Rank the following acids below from 1-3, 1 being the **least** acidic, 3 being the most.



2



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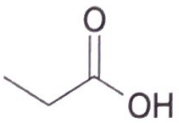
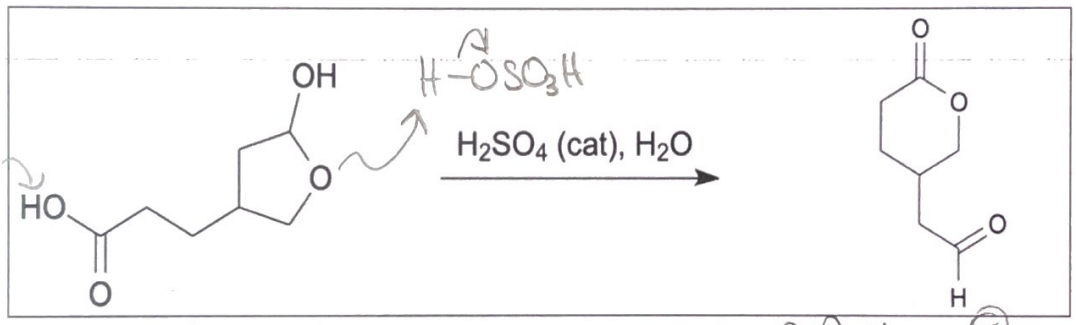
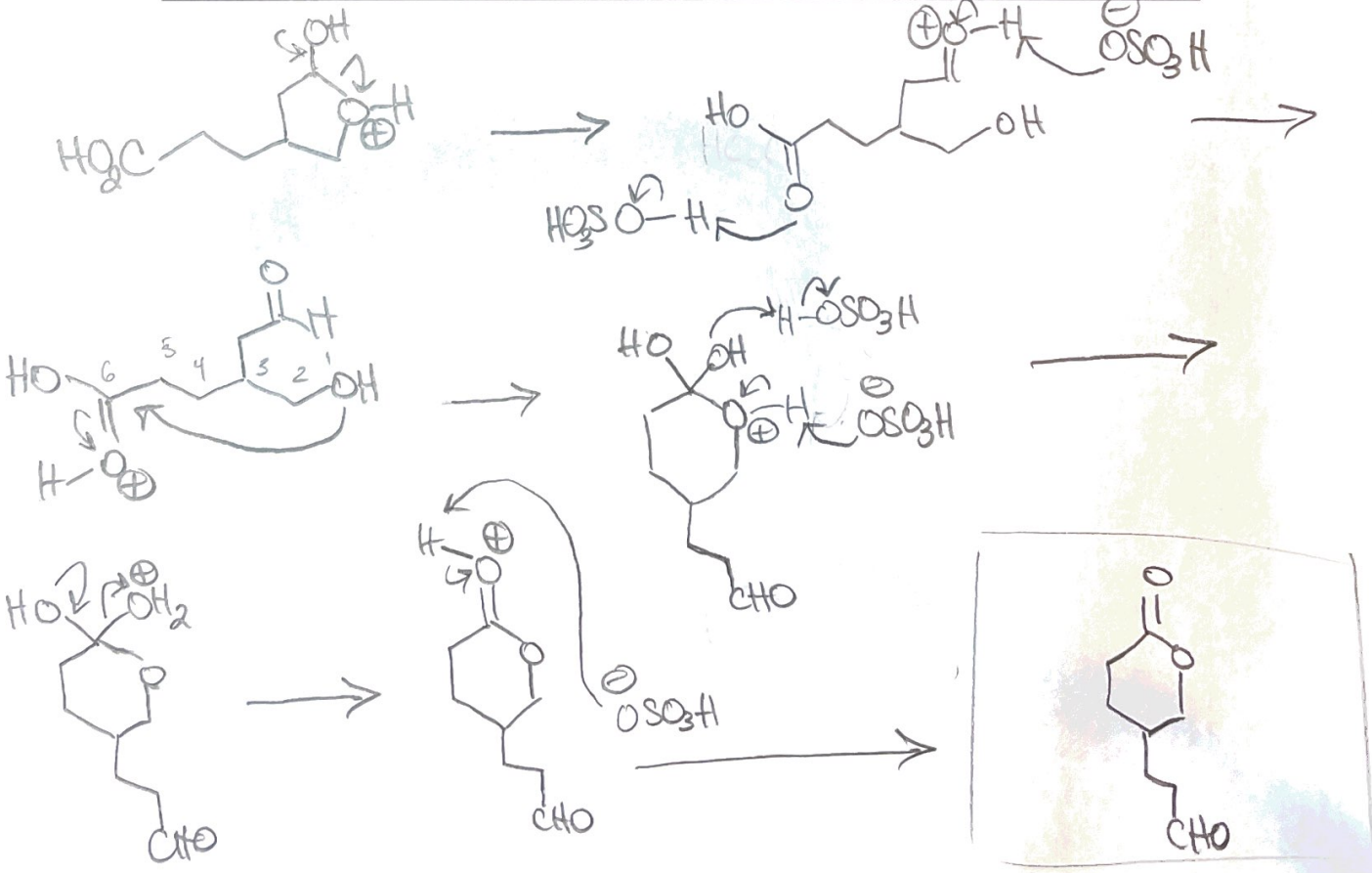


1

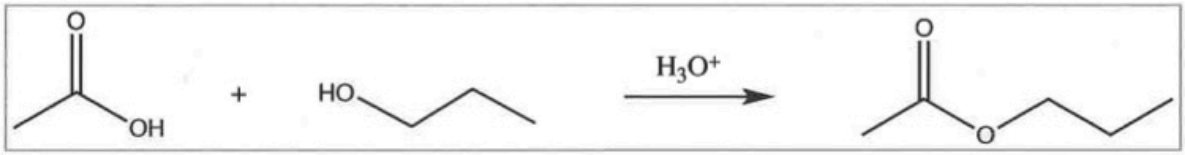
   b. Draw an arrow pushing mechanism to explain the transformation shown below:

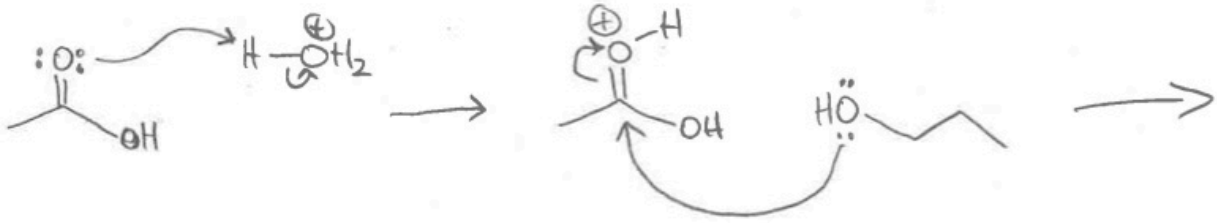


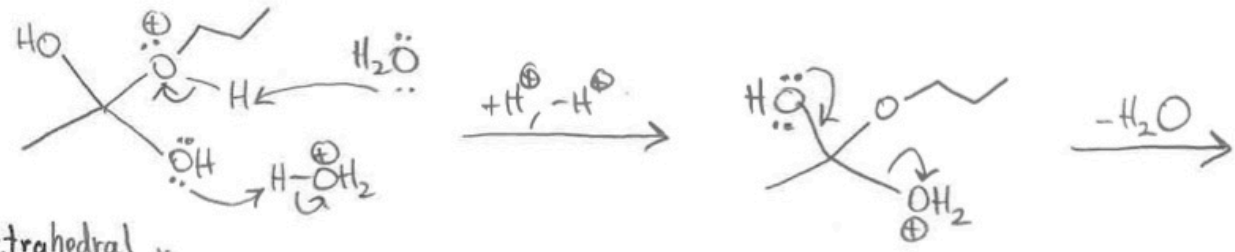


Ester Formation (carboxylic acid + alcohol = ester)

Draw the mechanism for the following esterification reaction (fancy word for ester formation, remember?). Remember—only positive charges in this mechanism, so protonate as/where necessary.



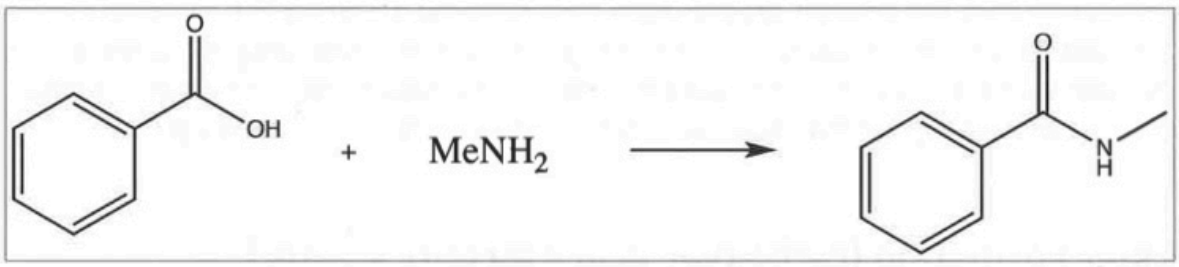


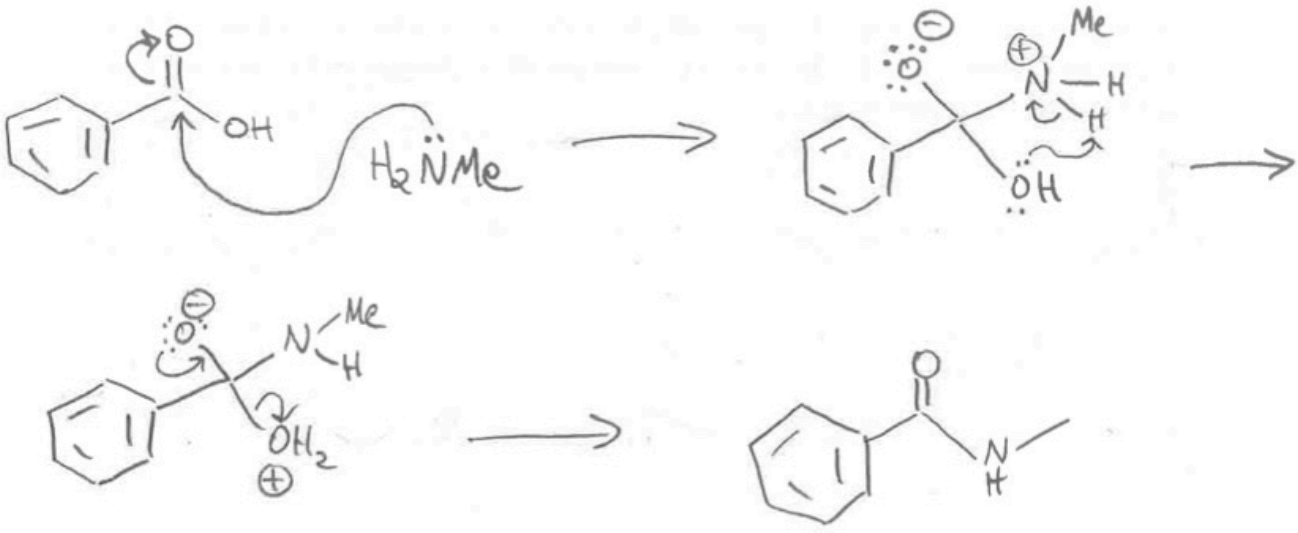


tetrahedral intermediate

Amide Formation (carboxylic acid + amine = amide)

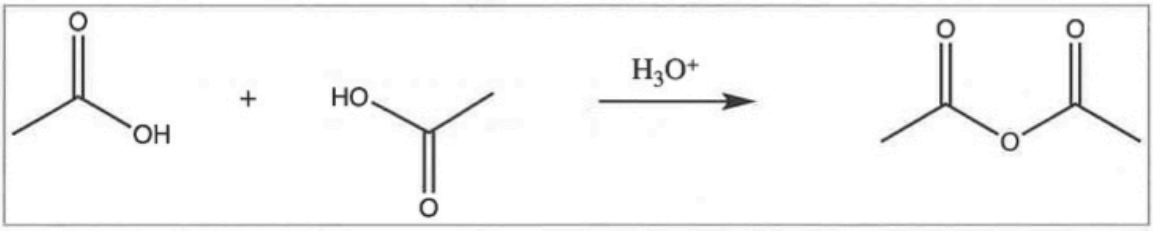
Draw the mechanism for the following amide formation reaction. Remember—unlike in esterification we can have **both** positive and negative charges.

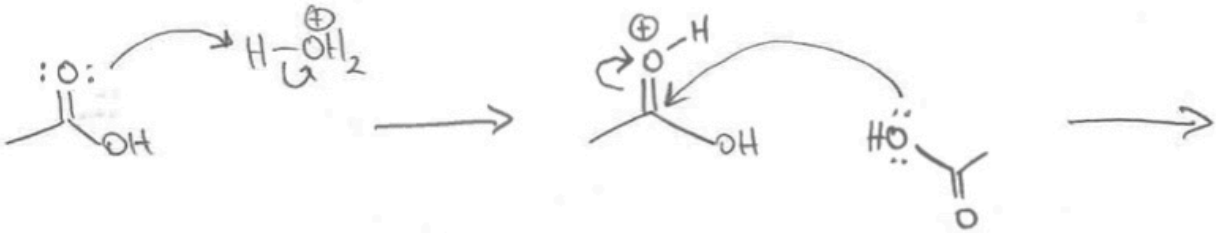


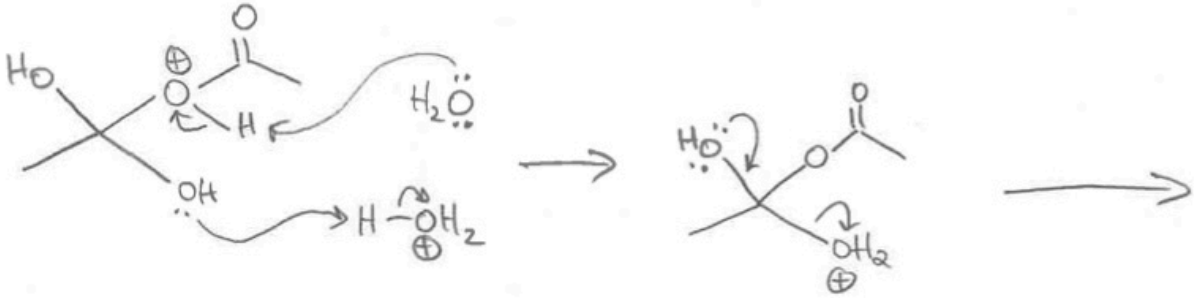


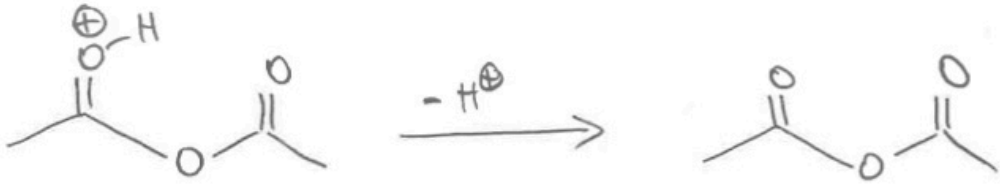
Acid Anhydride Formation (carboxylic acid + carboxylic acid = acid anhydride)

Draw the mechanism for the following acid anhydride formation reaction. That's right: we're smooshing 2 carboxylic acids together ☺. Just like in esterification, this is an acidic environment, so positive charges only, so protonate as/where necessary.









Acid Chloride Formation

Okay, so this isn't a **majorly** important mechanism to know, and you may never be asked it on an exam. However, I'm a firm believer in practicing most mechanisms to have a deeper understanding of how the reaction proceeds.

****But definitely**, have this reaction memorized****

Draw the mechanism for the following acid chloride formation reaction.
(**Hint:** to start remember which oxygen is the nucleophilic one in the carboxylic acid)