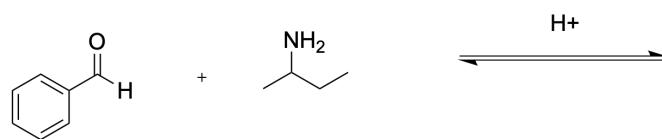
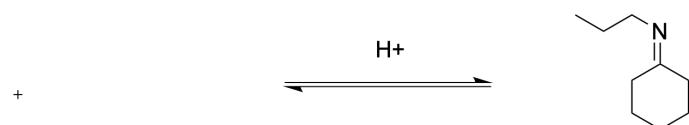
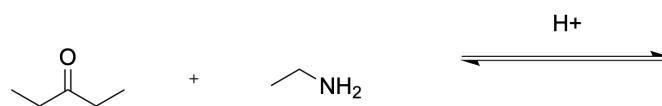


10.1 Imine formation

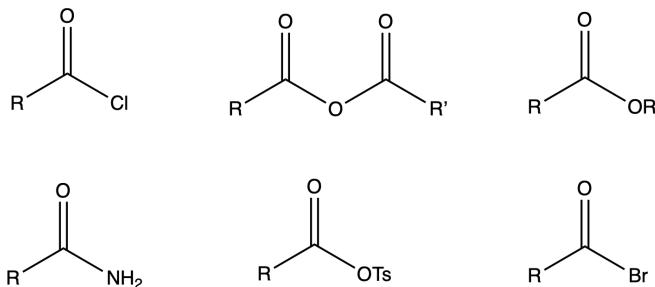
a) Draw the enzymatic mechanism of imine formation. Which step is different to the formation of acetal/ketals?

b) Fill in the blanks in the reactions below. Explain which reaction step requires acid-catalysis during imine formation.



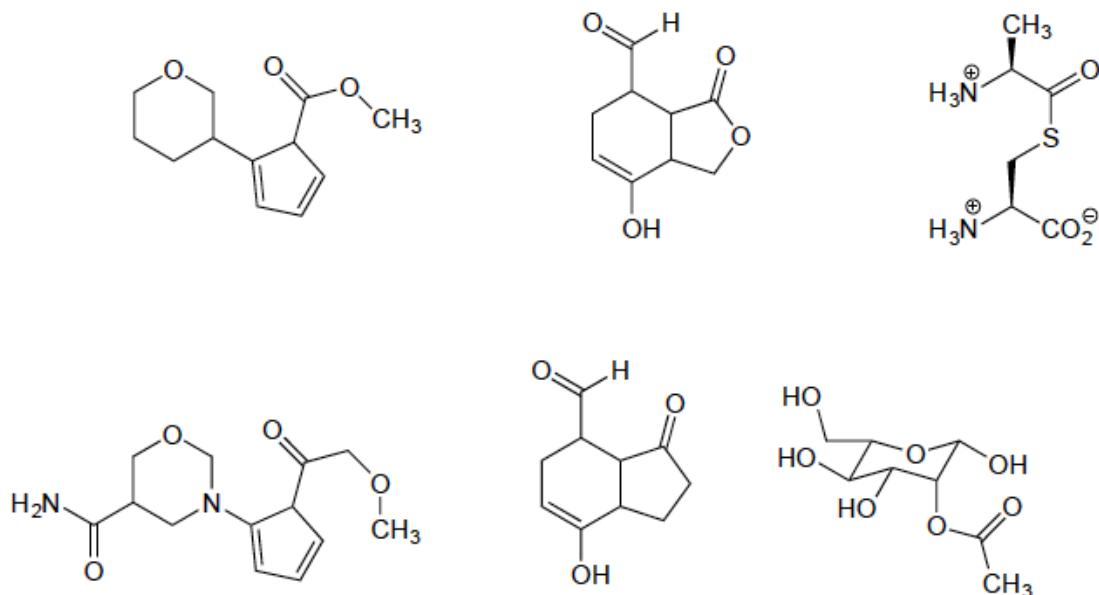
10.2 Nucleophilic acyl substitutions: Reactivity

Rank the following carboxylic acid derivatives by their reactivity with the nucleophile water and hypothesize about the required reaction conditions for the most and the least reactive compounds.



10.3 Nucleophilic acyl substitutions: Carboxylic acid derivatives

a) Name all aldehydes, ketones and carboxylic acid derivative groups in the molecules below and indicate which part is the “acyl X group” (the acyl X group corresponds to the leaving group in an acyl substitution).



10.4 Nucleophilic acyl substitutions: Carboxylic acid derivatives

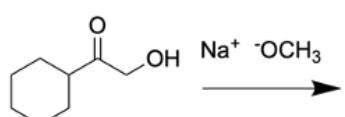
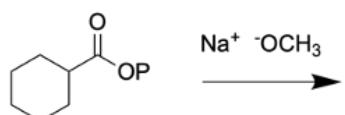
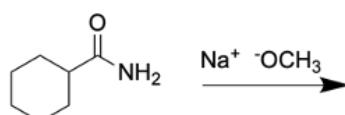
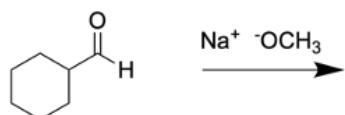
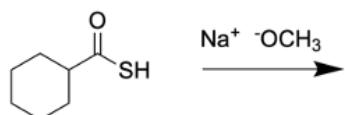
a) Draw the 2 steps of a nucleophilic substitution to a carbonyl. Use arrows to indicate the movement of electrons.

b) The first mechanistic step is the same as in nucleophilic additions to carbonyls. Explain why this step is faster for aldehydes and ketones compared to carboxylic acid derivatives.

c) Explain why carboxylic acid derivatives undergo nucleophilic acyl substitutions and aldehyde and ketones do not.

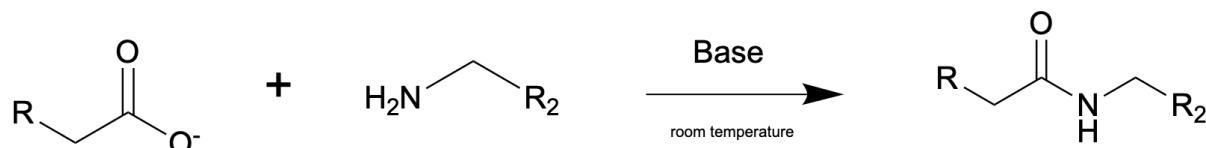
d) Repetition question/Important to understand concept: How does the strength of a leaving group (Y) correspond to the stability of the negative charge, basicity and the pK_a of its corresponding conjugate acid (HY)?

10.5 Draw the products of following reactions



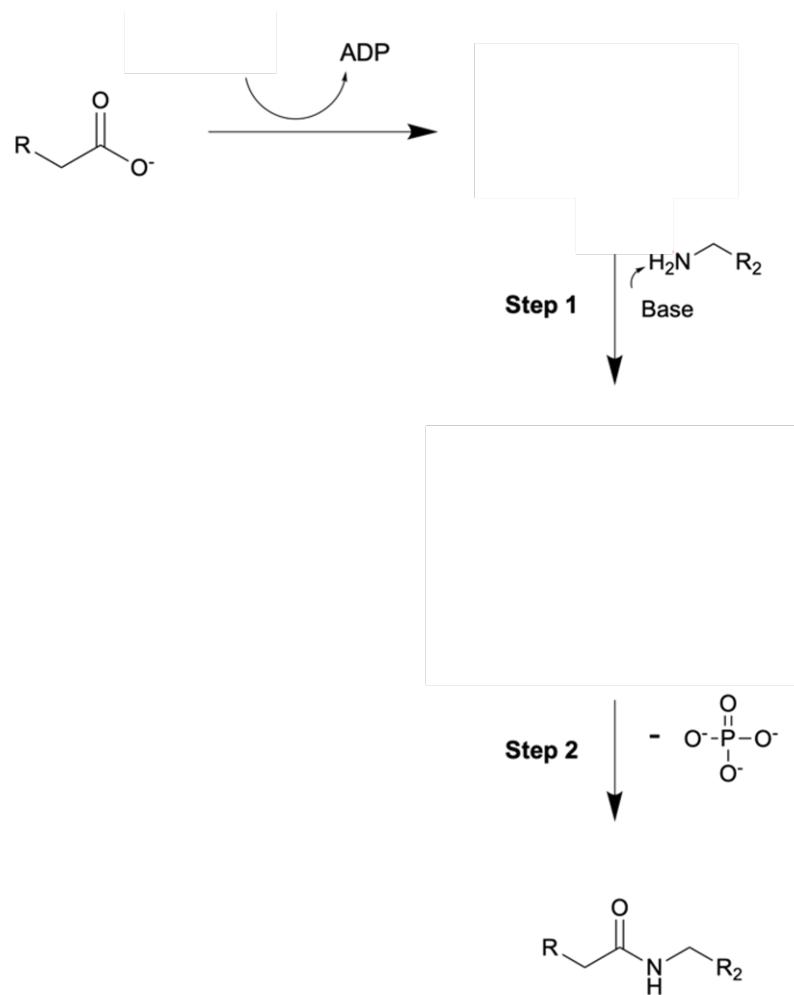
10.6 Activation of Carboxylic acid derivatives

a) Why does the following reaction not happen spontaneously?



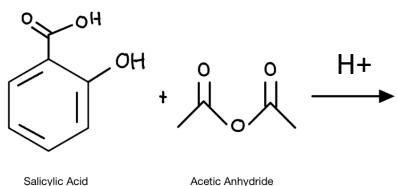
b) How, then, does a living system accomplish a reaction such as the one shown above? To what other, highly reactive carboxylic acid derivative are carboxylates mostly converted to in biological systems in order to become activated?

c) Fill in the blanks in following reaction scheme



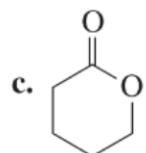
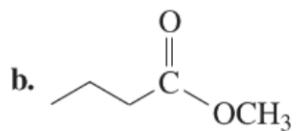
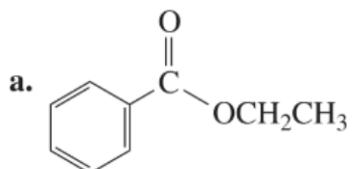
10.7 Aspirin Synthesis

The commercial preparation of Aspirin involves the following reaction of a benzene derivative with an anhydride. Draw a complete mechanism for this reaction:

**10.8 Ester Hydrolysis**

You have learned about ester hydrolysis under basic conditions. Try to reason from your previous experience of how acids react with carbonyl groups how hydrolysis works under acidic conditions.

a) What products are formed from an acid-catalyzed hydrolysis of the following esters.



b) Show the mechanism of the ester-hydrolysis under acidic conditions for c.