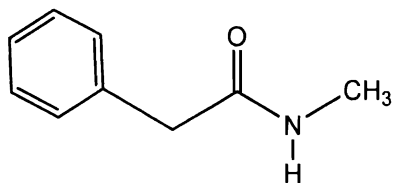


Blue Version

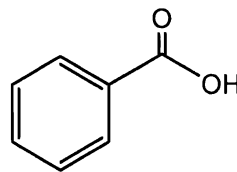
CHEM 243 Exam #1 (April 30, 09)

Name Sean Hunnity

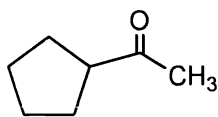
1. (8 pts) Name the functional group of each compound shown below:



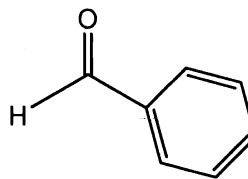
Functional group: *Amide*



Functional group: *carboxylic acid*



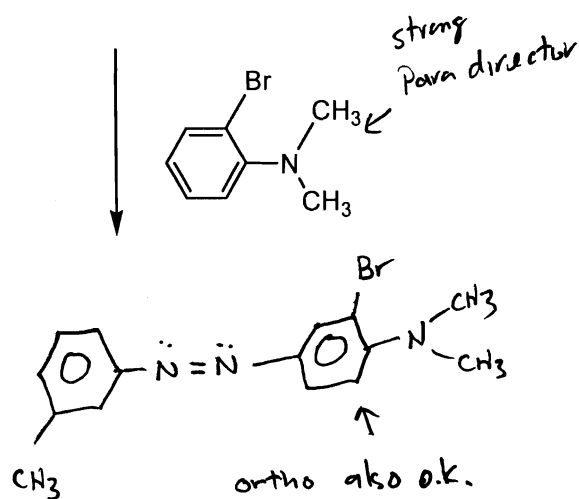
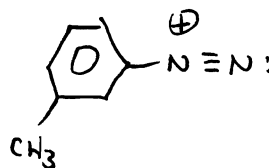
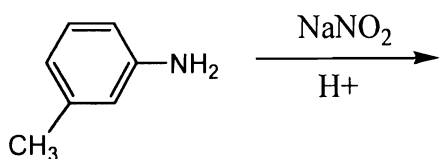
Functional group: *ketone*



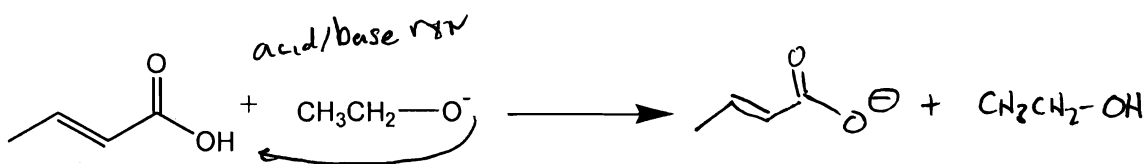
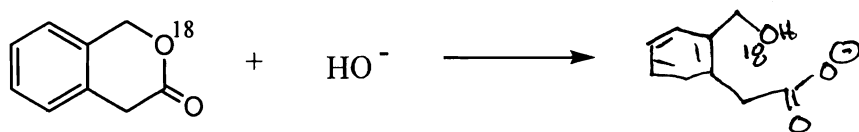
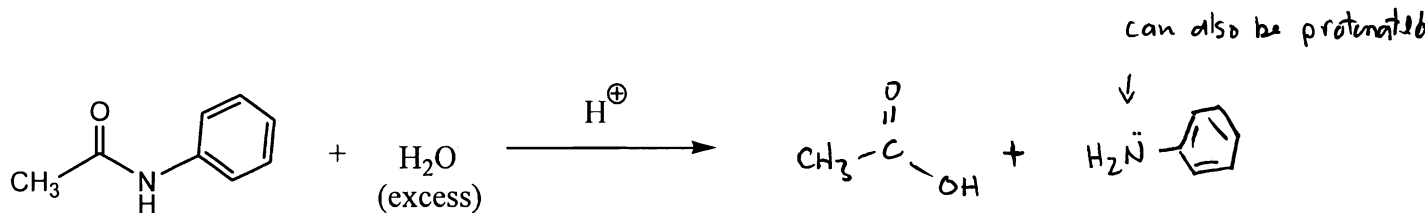
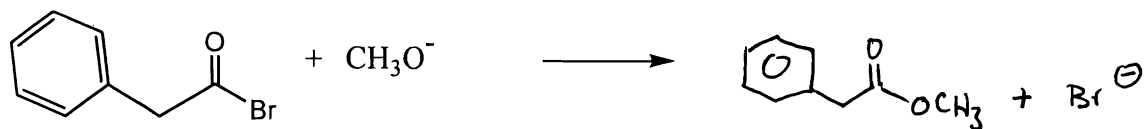
Functional group: *Aldehyde*

2. (6 pts) a Draw in the 'diazonium salt and final product of the Azo dye synthesis shown below.

Diazonium salt

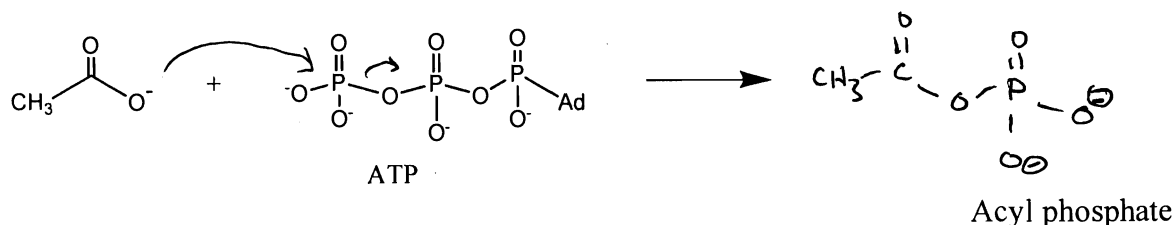


3. (5 pts each) Draw the major products of the following reactions. Write NR If there is no reaction. For the third problem be sure to note of oxygen 18 atoms and place it in the proper location in the products.

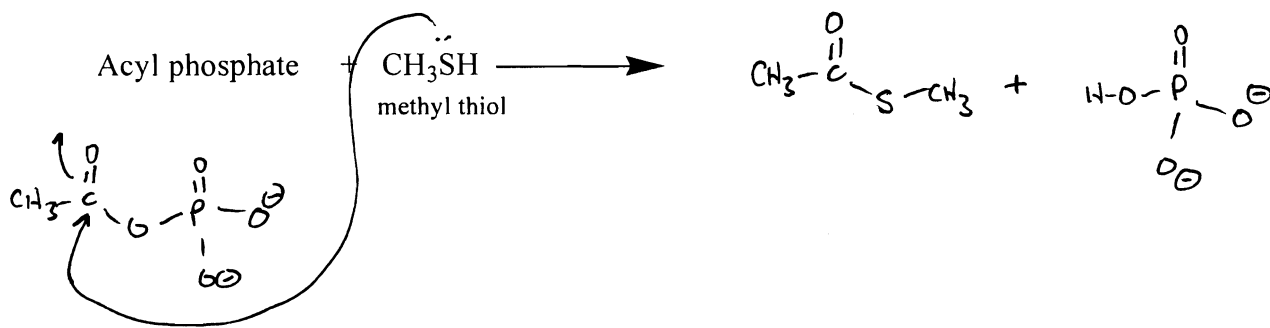


4. Sodium acetate reacts in the body with ATP (adenosine triphosphate) to make an activated acyl phosphate group that can then react with other nucleophiles such as methyl thiol.

a. (4 pts) Draw the acyl phosphate product of this reaction.



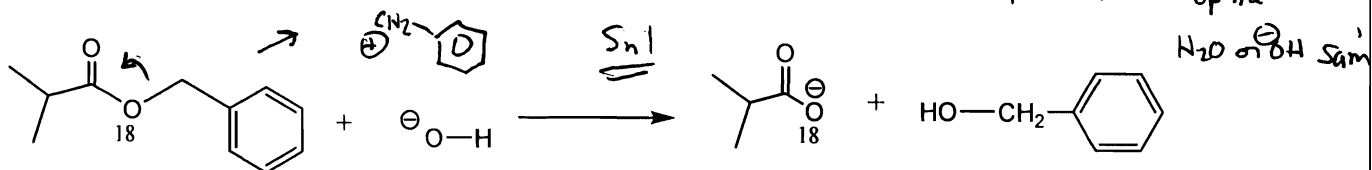
b. (3 pts) Draw **both products** of the reaction of the acyl phosphate (from above) with methyl thiol in the reaction shown below:



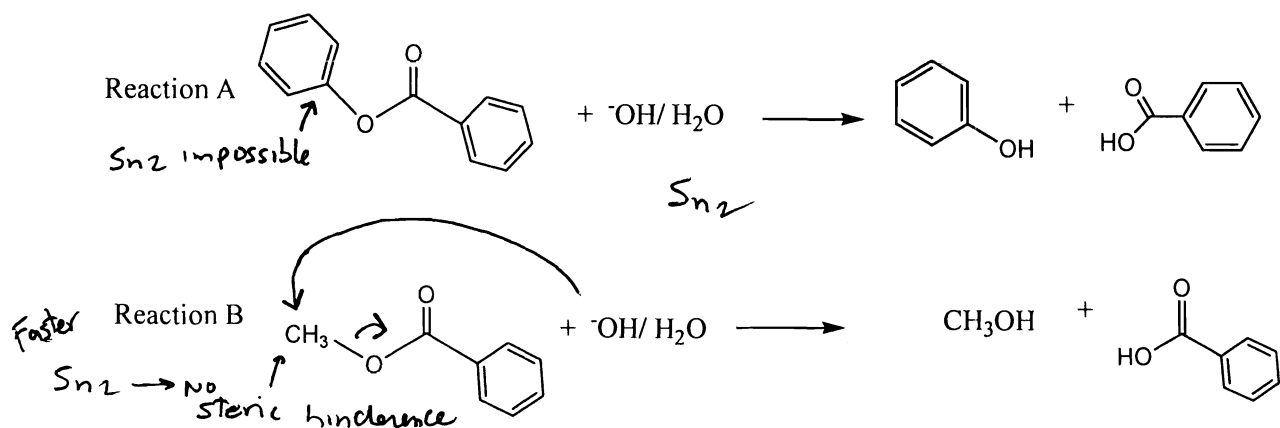




8. (5 pts) Which mechanism would best fit the results of the reaction below: Nucleophilic acyl substitution, Sn1 or Sn2 (circle one). Also note that when this reaction was run using water instead of hydroxide ion the reaction *proceeded at the same rate*. → Doesn't depend on nucleophile

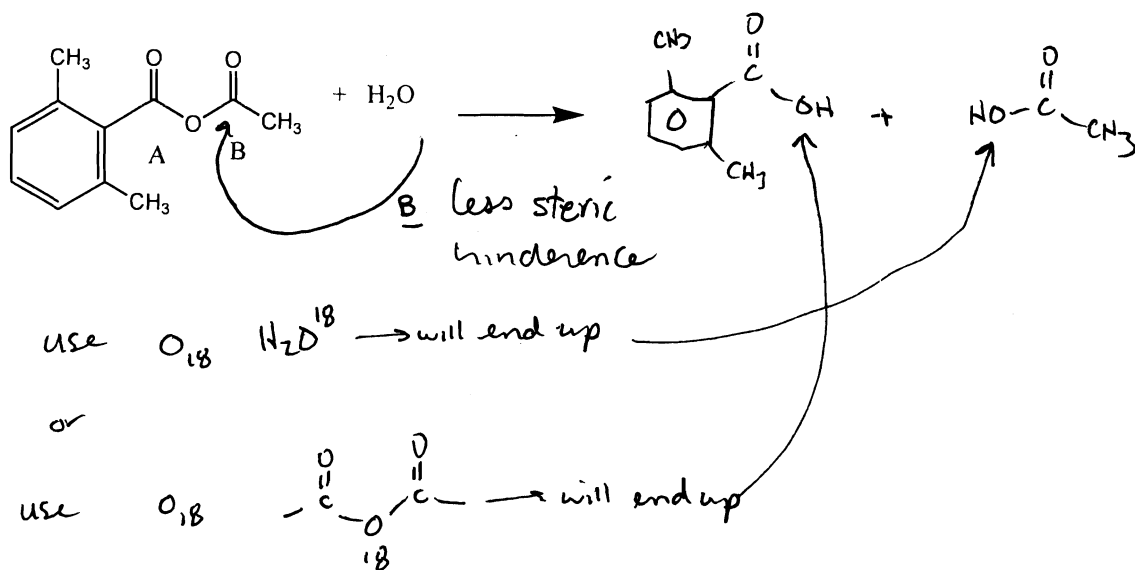


9. (5 pts) When comparing the ester hydrolysis reactions shown below, reaction B was 1000 times faster than reaction A—(Consider A to be unreactive). Which mechanism would best fit these results: Nucleophilic acyl substitution, Sn1 or Sn2 (circle one).



10. The reaction below proceeds by a nucleophilic acyl substitution reaction.

- (6 pts) Draw in the expected products
- (2 pts) Which carbonyl group (A or B) of the anhydride do you think is attacked by the water molecule in the first step of the mechanism (or are they equally attacked)?
- (4 pts) Devise an experiment (i.e. using isotope or rate experiments) that could help determine which carbonyl group is attacked by the water molecule in the first step.



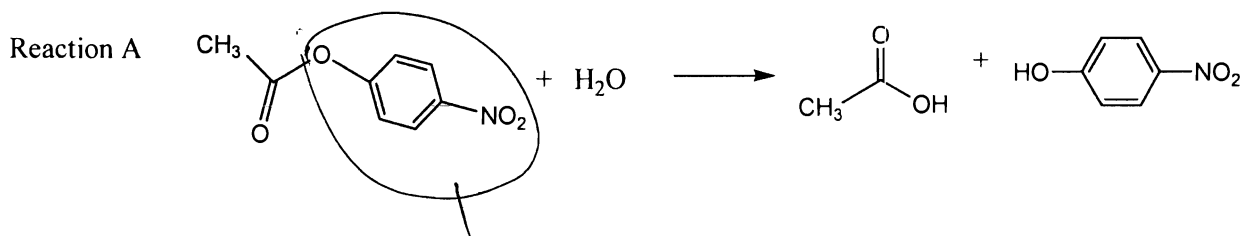
EXTRA CREDIT:

(1 pts) What famous mid-1980's movie featured the line "Wax on, Wax off" that mimics 'proton on, proton off' for the nucleophilic acyl substitution reaction? *(Karate Kid)*

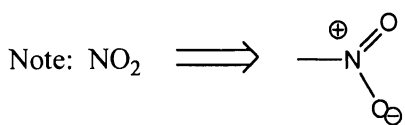
(1 pt) Who played the lead role? *Ralph machio (sp?)*

(1 pt) In what year did Victor Grignard win the Nobel prize for developing the Grignard Reagent? *1912*

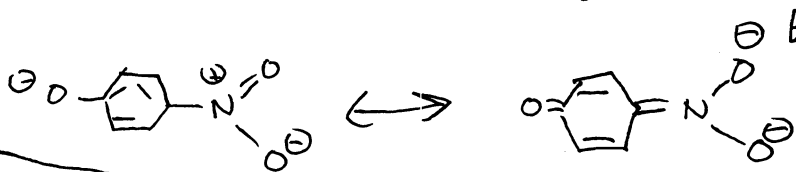
(5 pts) Reaction A proceeds at a rate 10 times faster than reaction B. Explain these results (Use resonance structures in your explanation to get full credit).



*Better leaving group due to resonance stabilization of nitro group*



*has superior resonance structure  $\rightarrow$  has  $\ominus$*

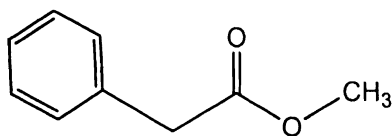
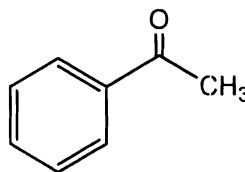
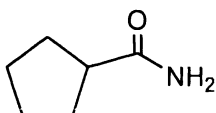
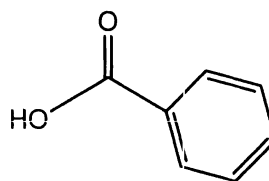


*3 other with ~~Carbom~~ Carbon  $\ominus$*

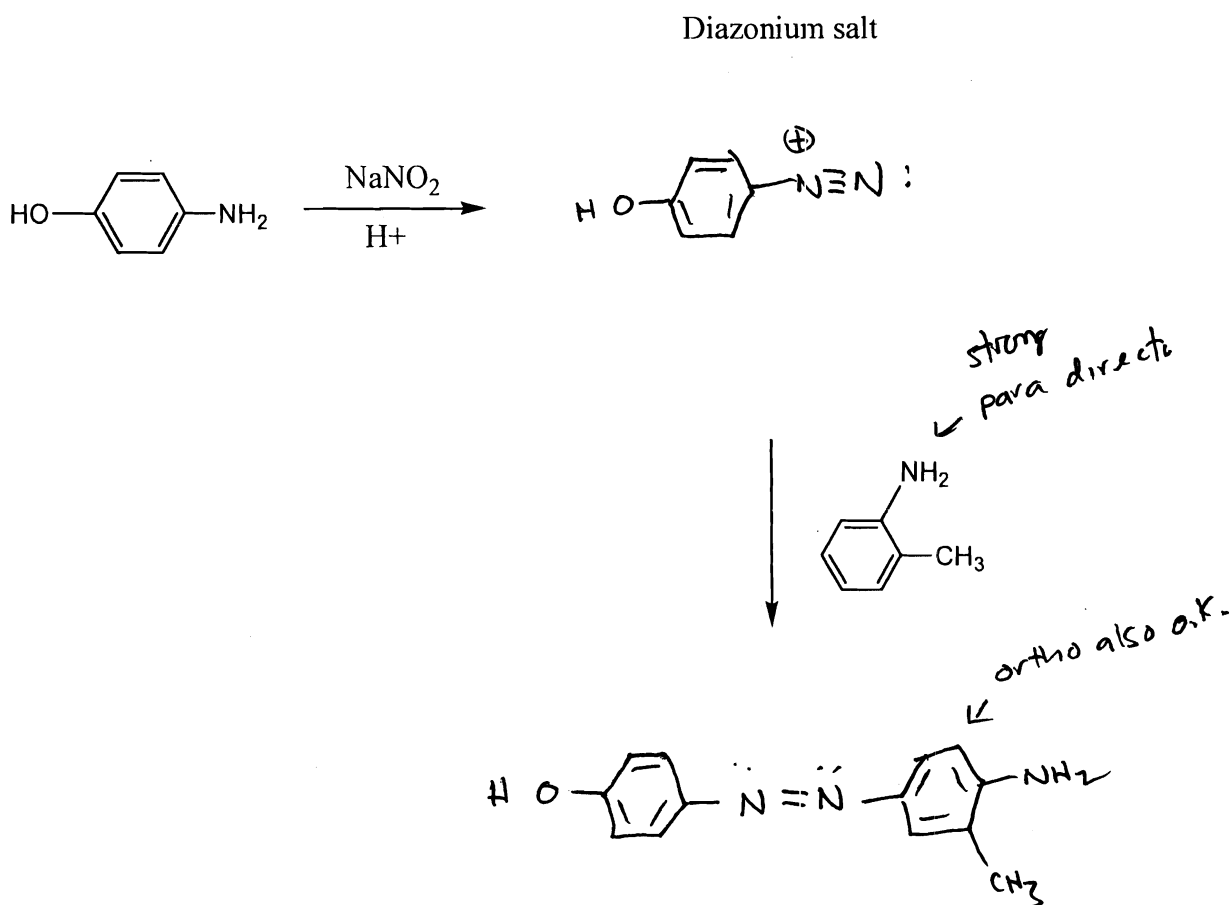


*cannot delocalize  $\ominus$  out to oxygen on nitro group*

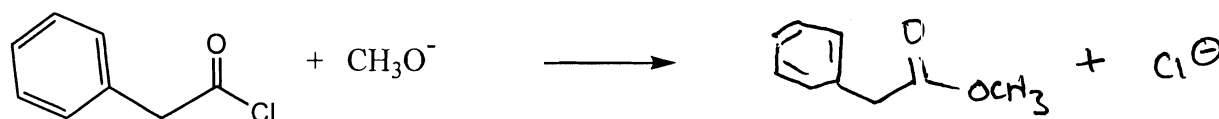
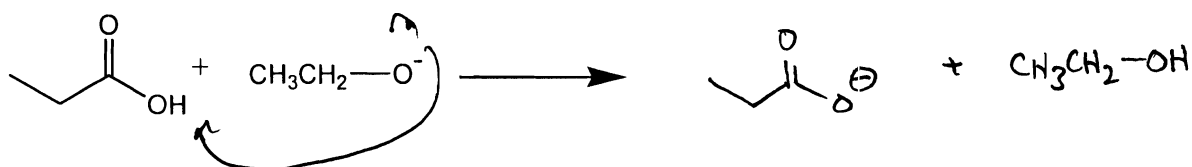
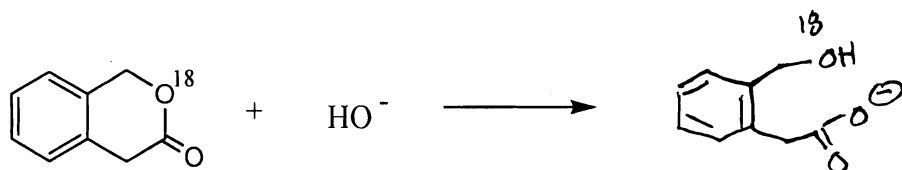
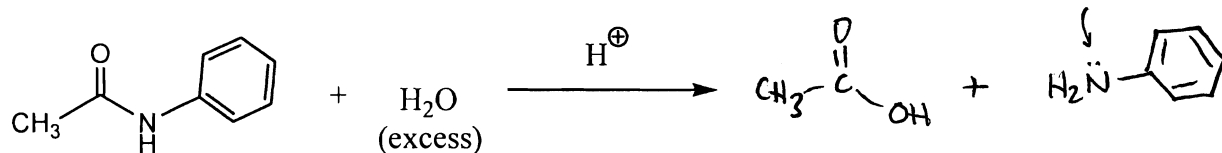
1. (8 pts) Name the functional group of each compound shown below:

Functional group: *ester*Functional group: *ketone*Functional group: *Amide*Functional group: *carboxylic acid*

2. (6 pts) a Draw in the 'diazonium salt and final product of the Azo dye synthesis shown below.

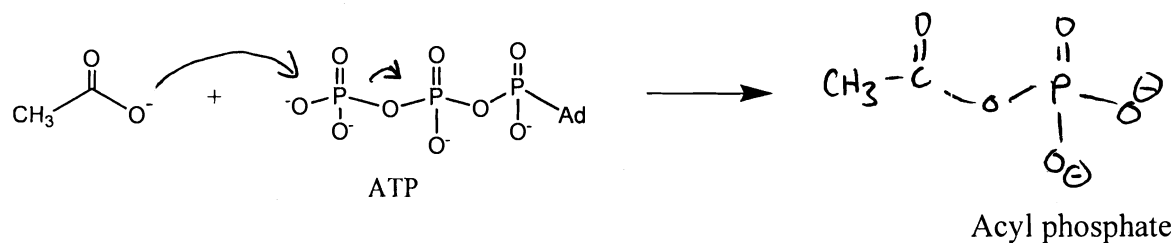


3. (5 pts each) Draw the major products of the following reactions. Write NR If there is no reaction. For the third problem be sure to note of oxygen 18 atoms and place it in the proper location in the products.

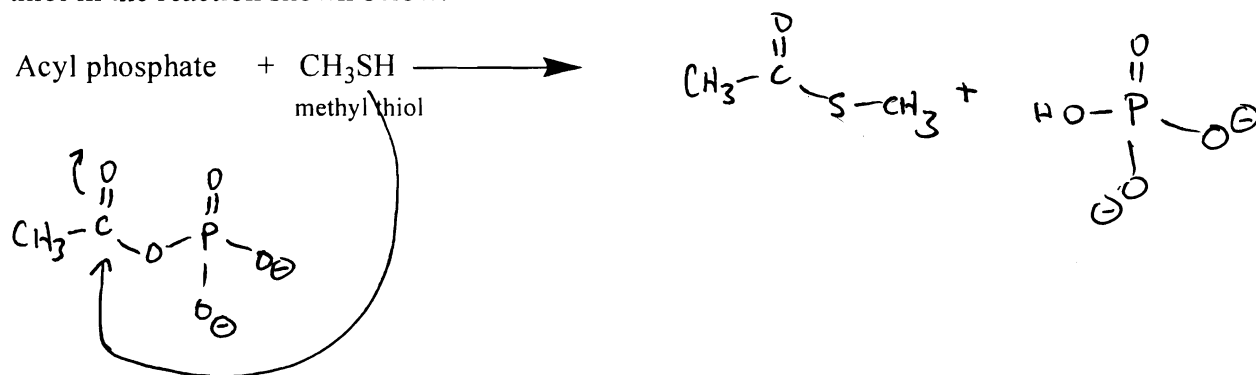


4. Sodium acetate reacts in the body with ATP (adenosine triphosphate) to make an activated acyl phosphate group that can then react with other nucleophiles such as methyl thiol.

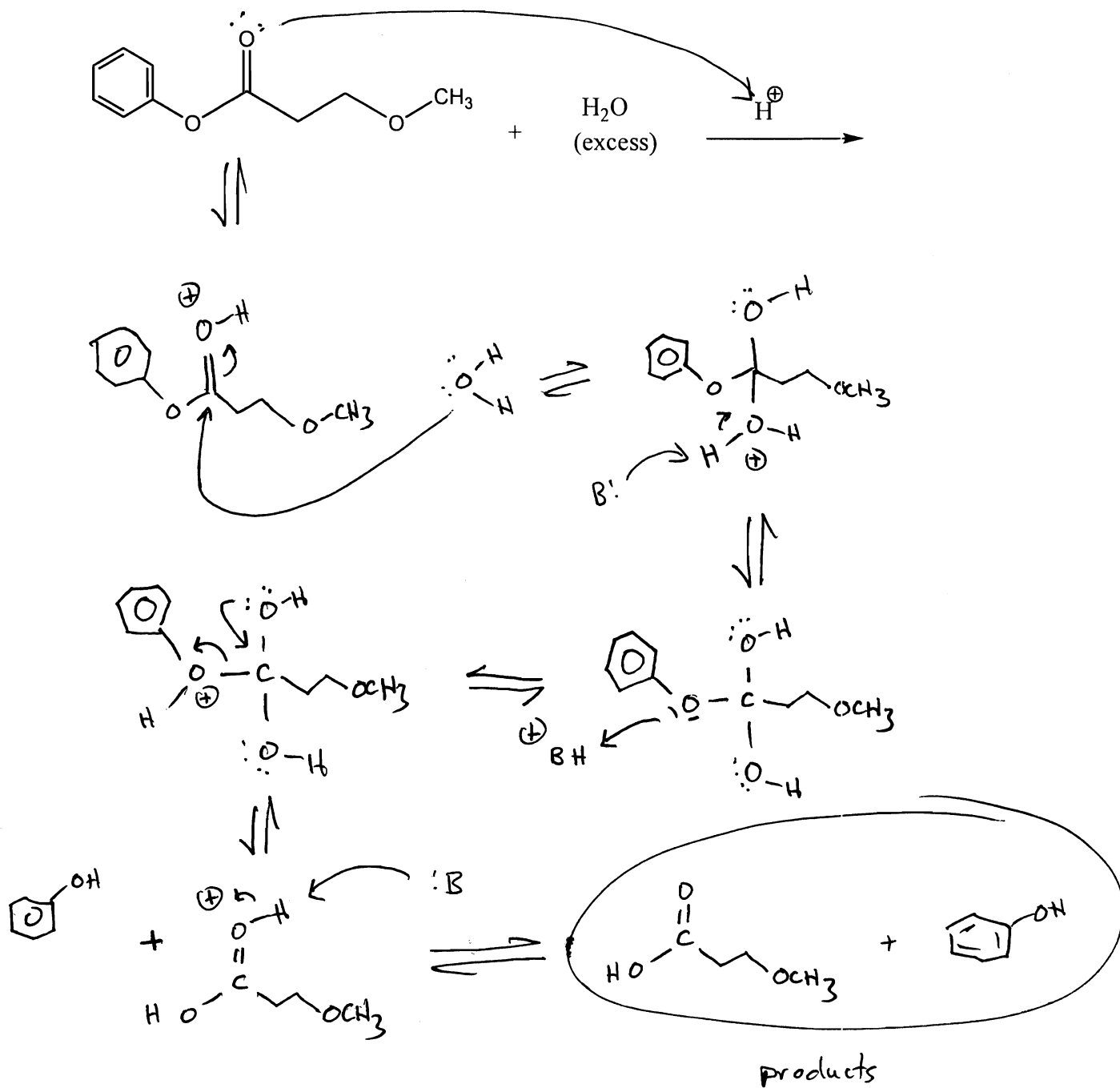
a. (4 pts) Draw the acyl phosphate product of this reaction:



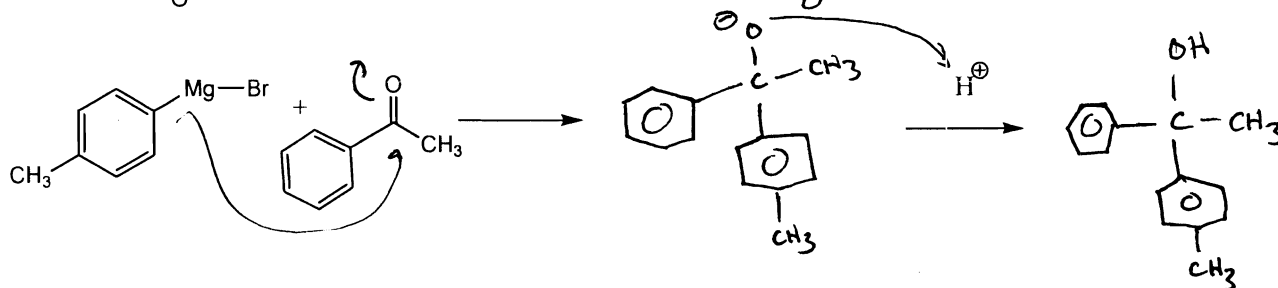
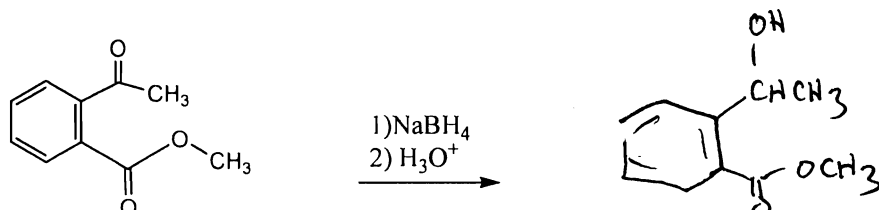
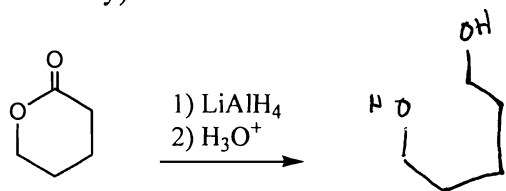
b. (3 pts) Draw **both products** of the reaction of the acyl phosphate (from above) with methyl thiol in the reaction shown below:



5. (16 pts) Carefully draw the arrow pushing **mechanism and products** of the acid catalyzed hydrolysis reaction shown below. Be sure to put in all appropriate formal charges.

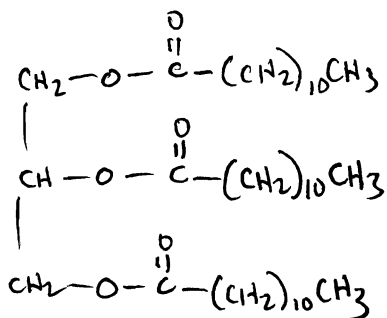
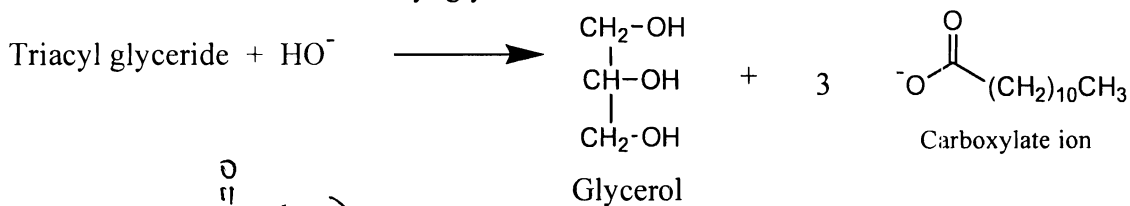


6. (5 pts each) Draw in the products for the reactions below. (You do not need to show stereochemistry)



7. (4 pts) Triacyl glycerides undergo a base catalyzed ester hydrolysis when they are reacted with hydroxide ion. The product of these reactions makes 3 molecules of 'carboxylate ion' and glycerol as shown in the reaction below.

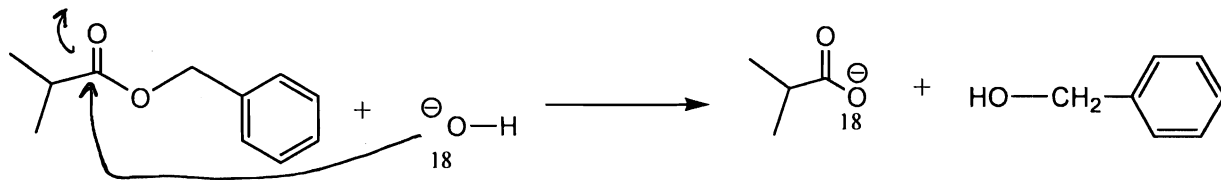
Draw the structure of the triacyl glyceride used in this reaction



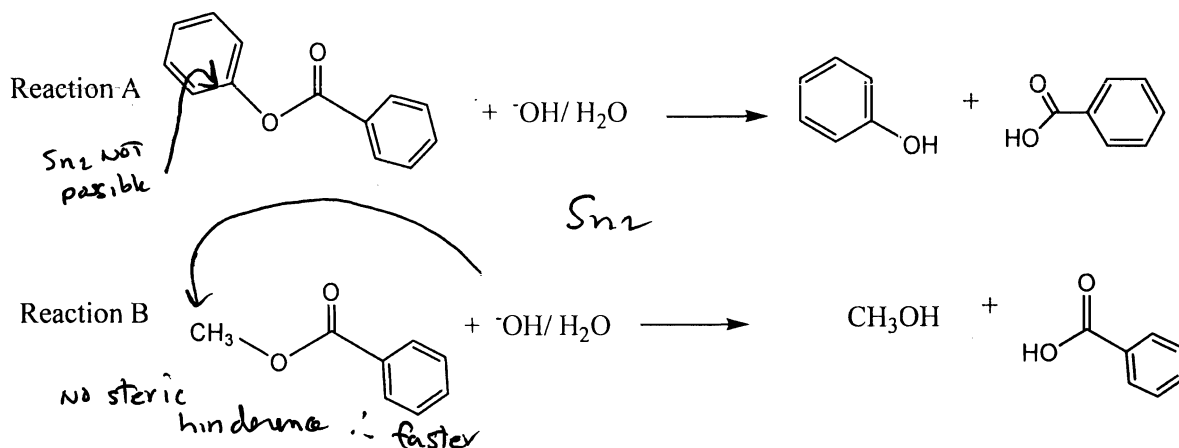
b. (2 pts) What is a common (and ancient) use of the carboxylate ions produced in these reactions

Soap

8. (5 pts) Which mechanism would best fit the results of the reaction below: Nucleophilic acyl substitution,  $S_N1$  or  $S_N2$  (circle one). Also note that when this reaction was run using water instead of hydroxide ion the reaction *proceeded at slower rate*.

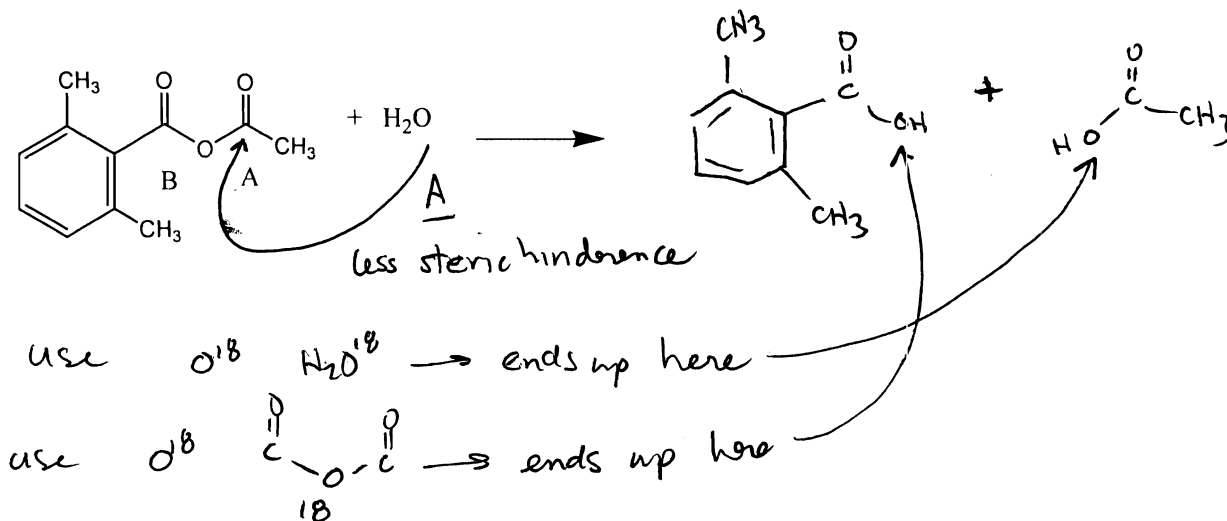


9. (5 pts) When comparing the ester hydrolysis reactions shown below, reaction B was 1000 times faster than reaction A—(Consider A to be unreactive). Which mechanism would best fit these results: Nucleophilic acyl substitution,  $S_N1$  or  $S_N2$  (circle one).



10. The reaction below proceeds by a nucleophilic acyl substitution reaction.

- (6 pts) Draw in the expected products
- (2 pts) Which carbonyl group (A or B) of the anhydride do you think is attacked by the water molecule in the first step of the mechanism (or are they equally attacked)?
- (4 pts) Devise an experiment (i.e. using isotope or rate experiments) that could help determine which carbonyl group is attacked by the water molecule in the first step.



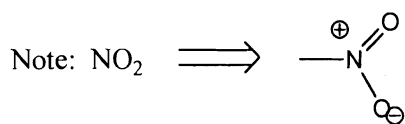
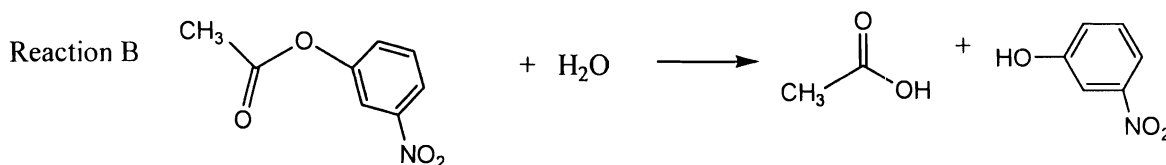
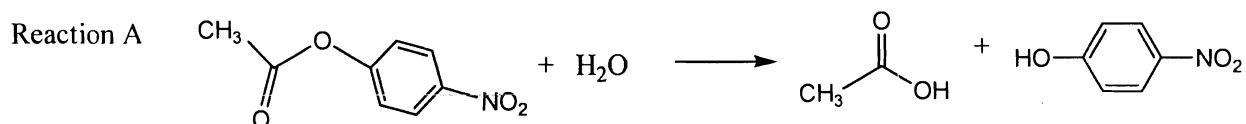
EXTRA CREDIT:

(1 pts) What famous mid-1980's movie featured the line "Wax on, Wax off" that mimics 'proton on, proton off' for the nucleophilic acyl substitution reaction? *Karate Kid*

(1 pt) Who played the lead role? ~~Karate Kid~~ *Ralph Macchio (sp?)*

(1 pt) In what year ~~did~~ Victor Grignard win the Nobel prize for developing the Grignard Reagent? *1912*

(5 pts) Reaction A proceeds at a rate 10 times faster than reaction B. Explain these results (Use resonance structures in your explanation to get full credit).



*See 'Blue' Key for answer*