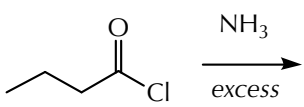
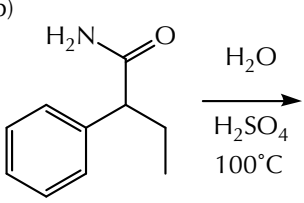
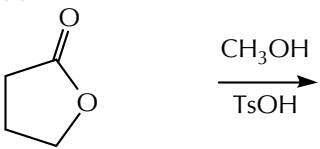
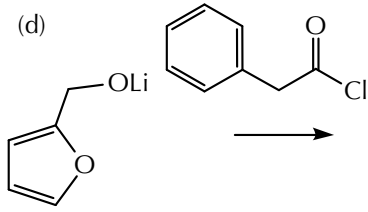


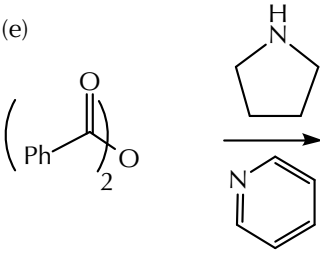
13.06 Provide the product from the following acylation reactions. Identify the functional group of the acylating agent and of the product. State the number of steps that are anticipated for the acylation reaction mechanism.

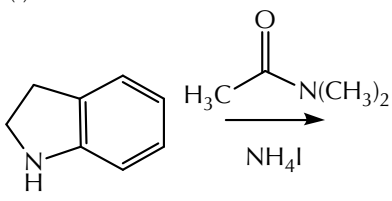
(a)  $\xrightarrow[\text{excess}]{\text{NH}_3}$ functional group (acylating agent)
 functional group (product)
 # of mechanistic steps

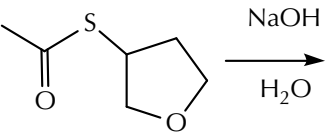
(b)  $\xrightarrow[100^\circ\text{C}]{\text{H}_2\text{SO}_4}$ H_2O functional group (acylating agent)
 functional group (product)
 # of mechanistic steps

(c)  $\xrightarrow[\text{TsOH}]{\text{CH}_3\text{OH}}$ functional group (acylating agent)
 functional group (product)
 # of mechanistic steps

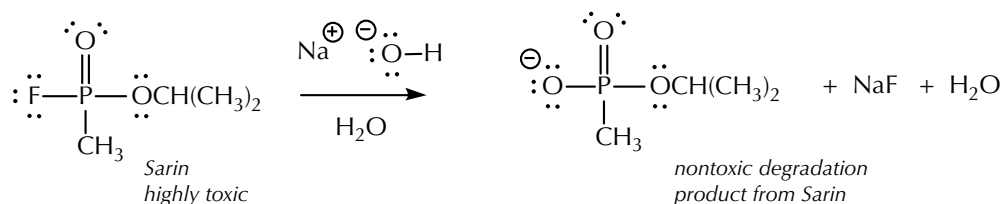
(d)  $\xrightarrow{\text{C}_6\text{H}_5\text{COCl}}$ functional group (acylating agent)
 functional group (product)
 # of mechanistic steps

(e)  $\xrightarrow{\text{pyrrolidine}}$ $\xrightarrow{\text{pyridine}}$ functional group (acylating agent)
 functional group (product)
 # of mechanistic steps

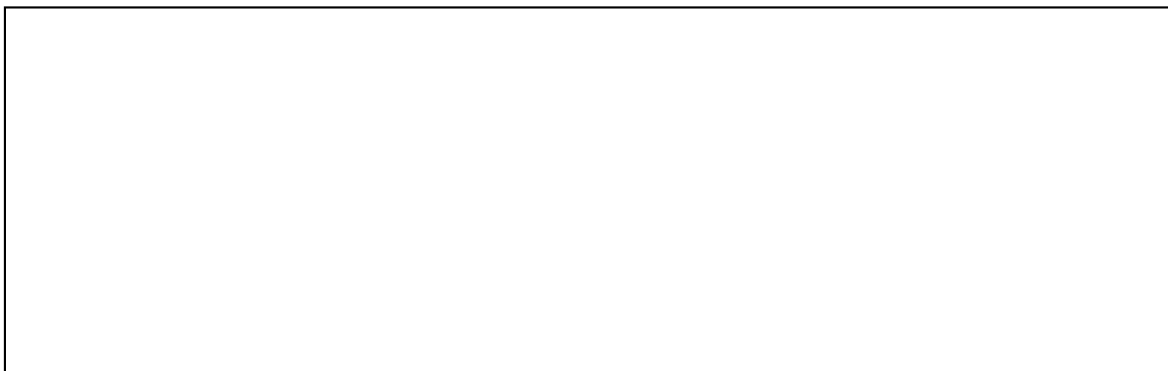
(f)  $\xrightarrow[\text{NH}_4\text{I}]{\text{H}_3\text{C-CO-N(CH}_3)_2}$ functional group (acylating agent)
 functional group (product)
 # of mechanistic steps

(g)  $\xrightarrow[\text{H}_2\text{O}]{\text{NaOH}}$ functional group (acylating agent)
 functional group (product)
 # of mechanistic steps

13.07 Sarin was the nerve gas used in a terrorist attack of a Tokyo subway station in 1995. The compound acts by inhibiting the enzyme cholinesterase, necessary to the deactivation of acetylcholine when its role in the transmission of a nerve impulse is over. Interference with the process of deactivation results in paralysis and death. Sarin is easily detoxified by treatment with base.



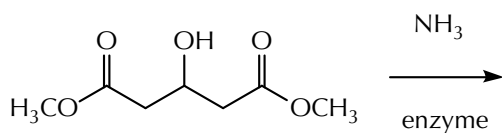
(a) If you treat the P=O as a carbonyl group, then the mechanism would be the same as the carbon-based acid halide functional group. Draw the complete, stepwise mechanism for this process using that assumption.



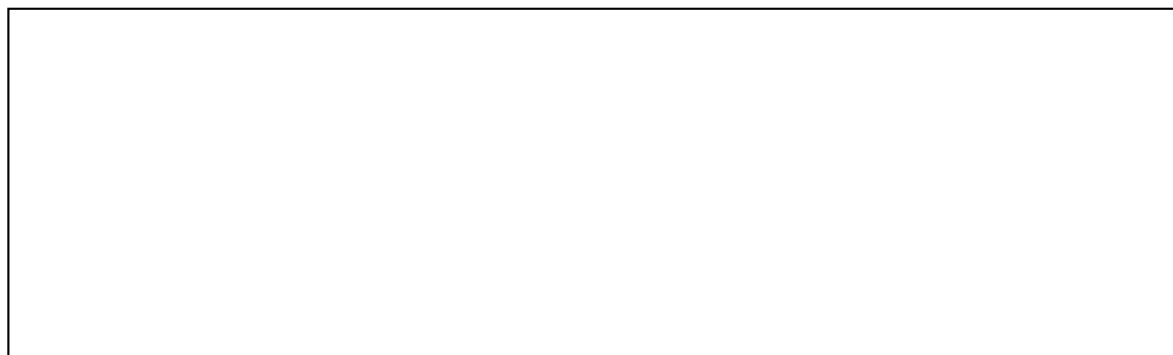
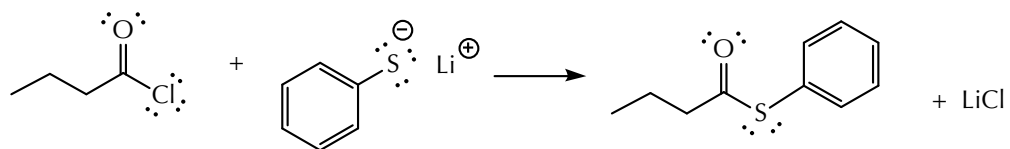
(b) Alternatively, the phosphorus atom is a large, tetrahedral atom attached to a leaving group, and another mechanism could be proposed. Draw the complete, stepwise mechanism for the alternative.



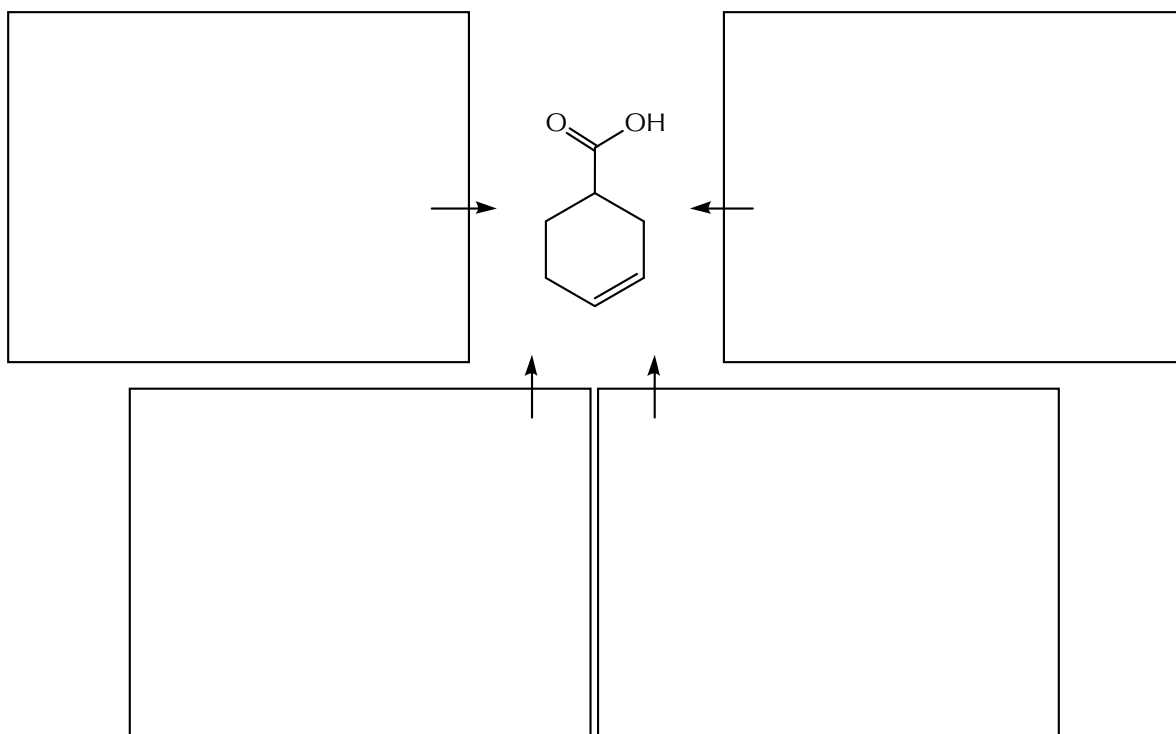
13.08 Chemists sometimes use enzymes to convert achiral compounds into chiral ones. The achiral diester shown below reacts with ammonia in the presence of an enzyme, derived from the microorganism *Candida antarctica*, selectively at one of the ester groups to give the (*S*)-enantiomer of the monomethylester-monoamide of 3-hydroxypentanedioic acid. Draw the structure of this product.



13.09 Provide the complete, stepwise mechanism for the following acylation reaction. Think carefully about the number of steps in the anticipated mechanism for this reaction before starting to draw anything.



13.10 Propose four different ways to prepare the following carboxylic acid using acylation reactions.



13.11 Complete the following reaction as needed.

