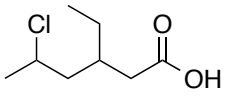
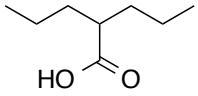
Chemistry 234
Chapter 20/21 Problem Set – Answer Key

Nomenclature

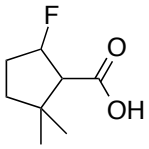
1) Provide the IUPAC name for each of the carboxylic acids below.



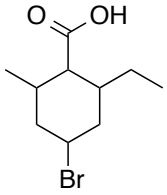
5-chloro-3-ethylhexanoic acid



2-propylpentanoic acid

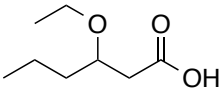


5-fluoro-2,2-dimethylcyclopentanecarboxylic acid

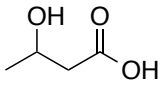


4-bromo-2-ethyl-6-methylcyclohexanecarboxylic acid

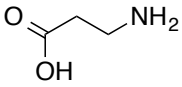
2) Provide the common name for each of the carboxylic acids below.



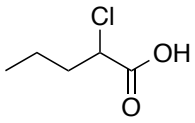
beta-ethoxycaproic acid



beta-hydroxybutyric acid

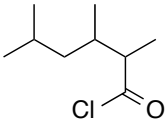


beta-aminopropionic acid

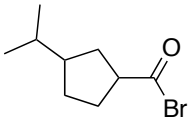


alpha-chlorovaleric acid

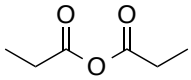
3) Provide the IUPAC name for each of the carboxylic acid derivatives below.



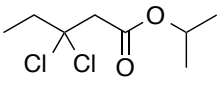
2,3,5-trimethylhexanoyl chloride



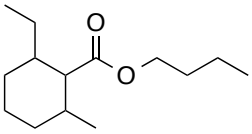
3-isopropylcyclopentanecarbonyl bromide



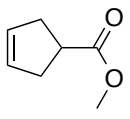
propionic anhydride



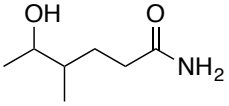
isopropyl 3,3-dichloropentanoate



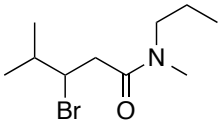
butyl 2-ethyl-6-methylcyclohexanecarboxylate



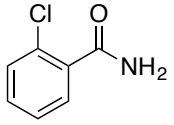
methyl 3-cyclopentenecarboxylate



5-hydroxy-4-methylhexanamide

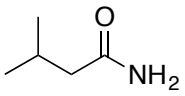


3-bromo-*N*,4-dimethyl-*N*-propylpentanamide

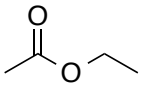


2-chlorobenzamide

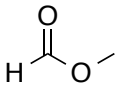
4) Provide the common name for each of the carboxylic acid derivatives below.



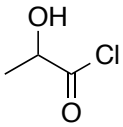
beta-methylbutyramide



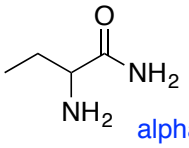
ethyl acetate



methyl formate

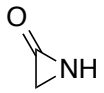


alpha-hydroxypropionyl chloride

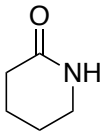


alpha-aminobutyramide

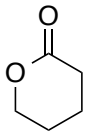
5) Give each compound below a designation using a Greek letter and the lactone or lactam name.



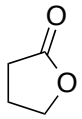
alpha-lactam



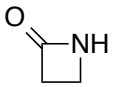
delta-lactam



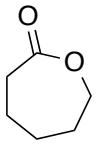
delta-lactone



gamma-lactone



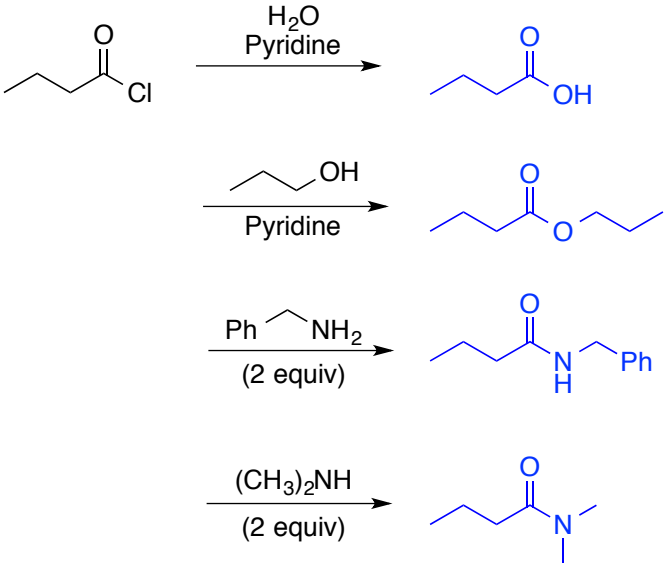
beta-lactam



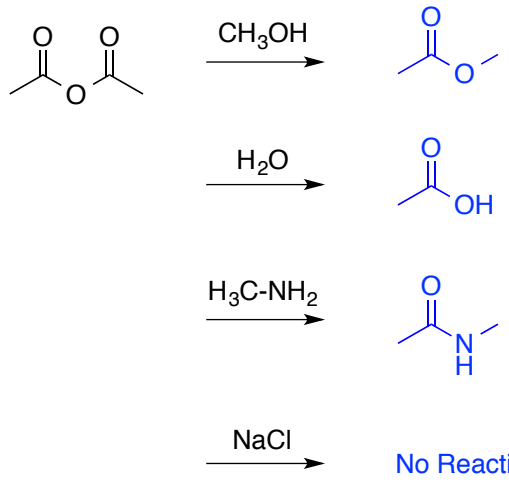
epsilon-lactone

Reactions

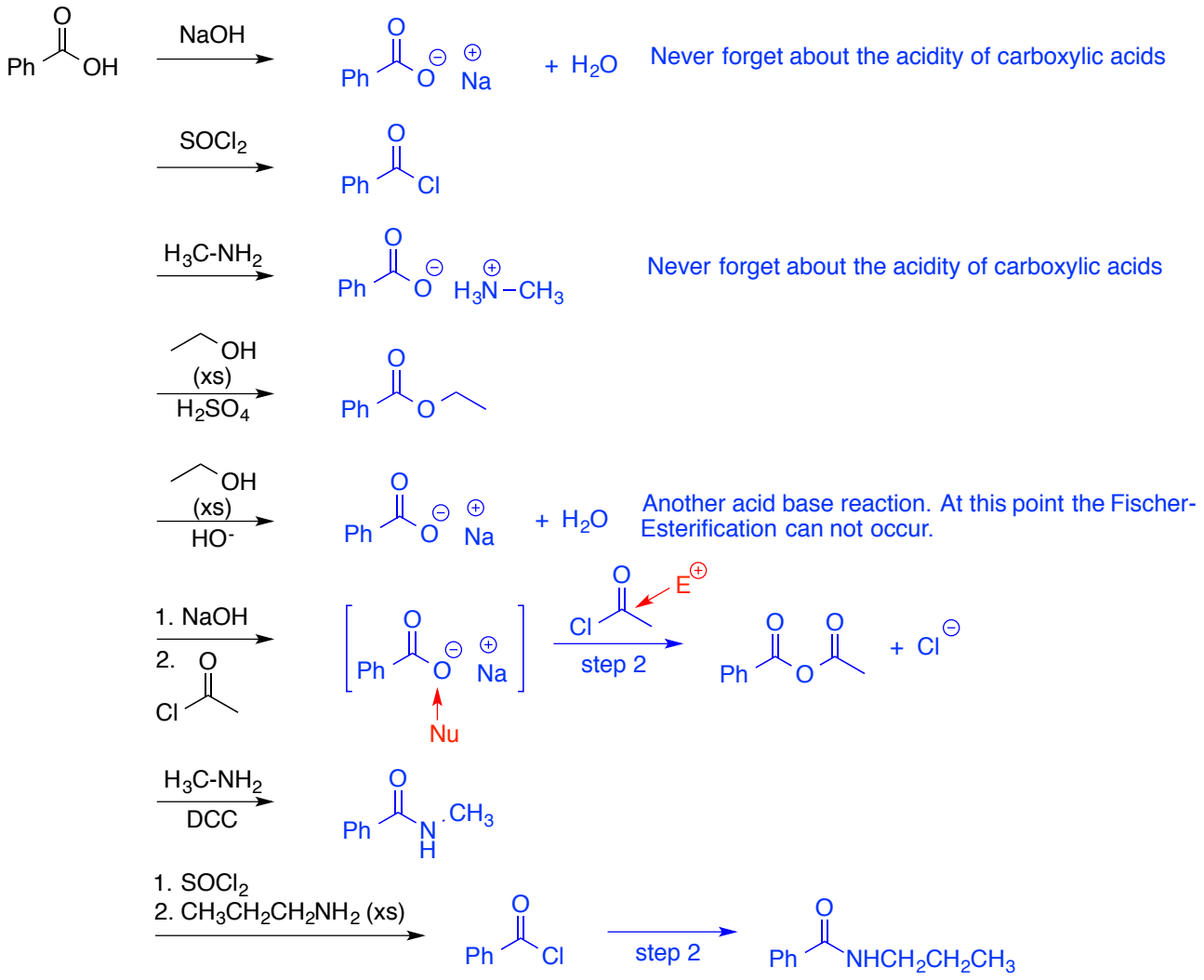
6) Predict the major organic product formed when butyryl chloride is reacted under each set of conditions below.



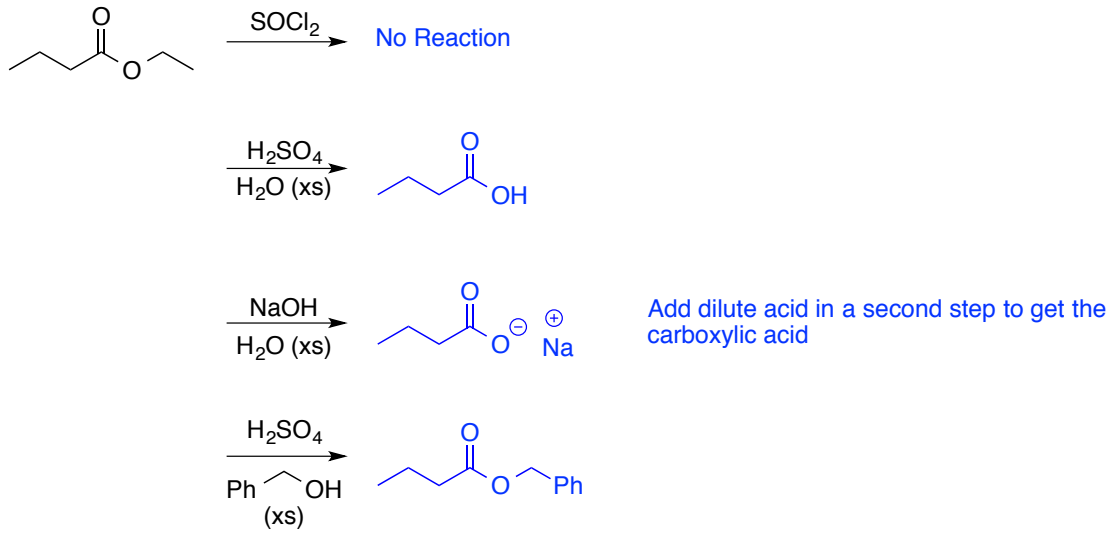
7) Predict the major organic product formed when acetic anhydride is reacted under each set of conditions below.



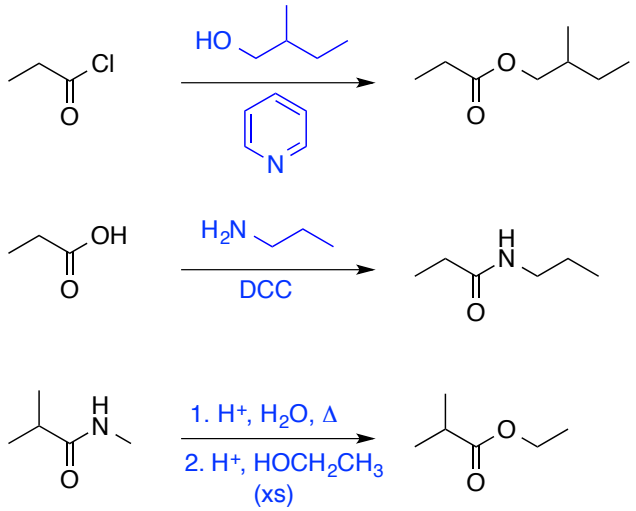
8) Predict the major organic product formed when benzoic acid is reacted under each set of conditions below.



9) Predict the major organic product formed when ethyl butanoate is reacted under each set of conditions below.

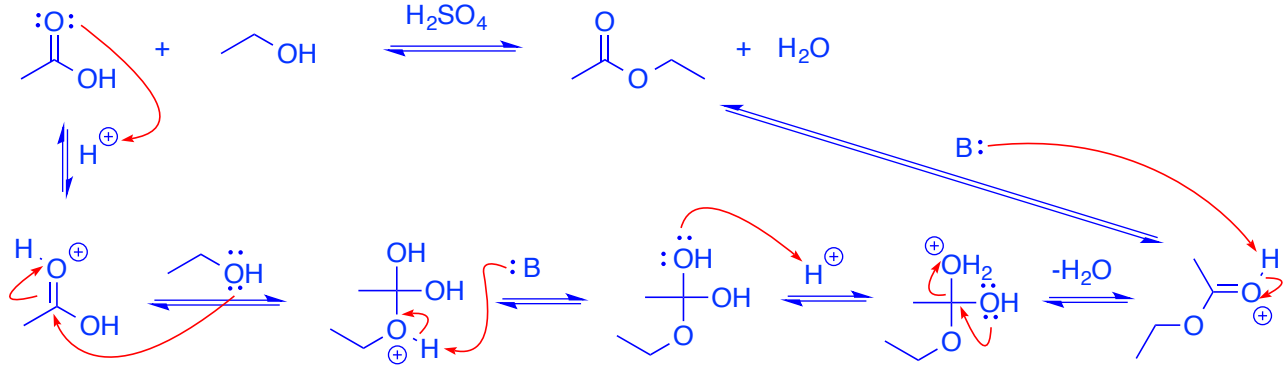


10) Provide the necessary reagents to carry out each of the following interconversions.

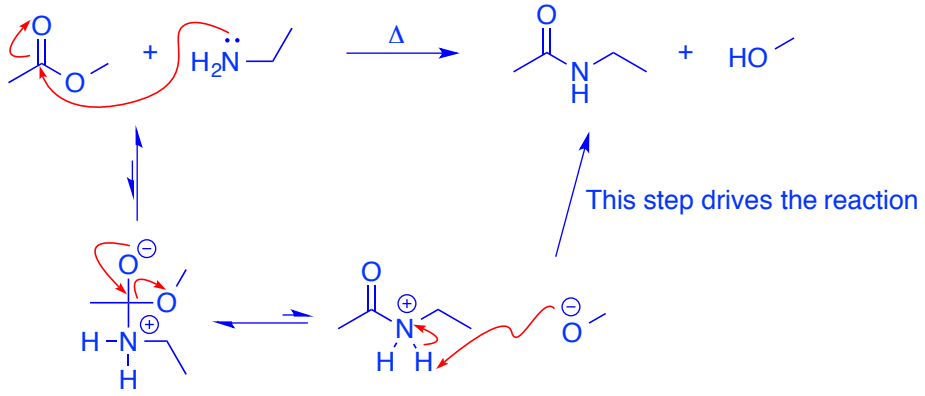


Mechanisms

11) Provide an electron pushing mechanism for the Fischer Esterification between acetic acid and excess ethanol.

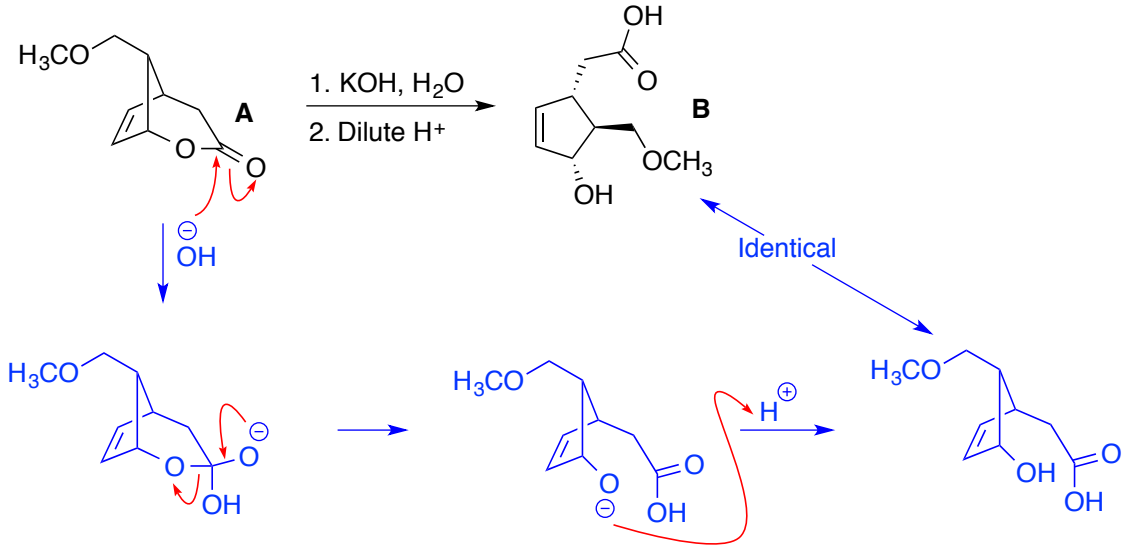


12) Draw the electron pushing mechanism for the aminolysis reaction shown below. An aminolysis is similar to a hydrolysis except an amine is used rather than water. Unlike hydrolysis, an acid catalyst cannot be used. Explain why.

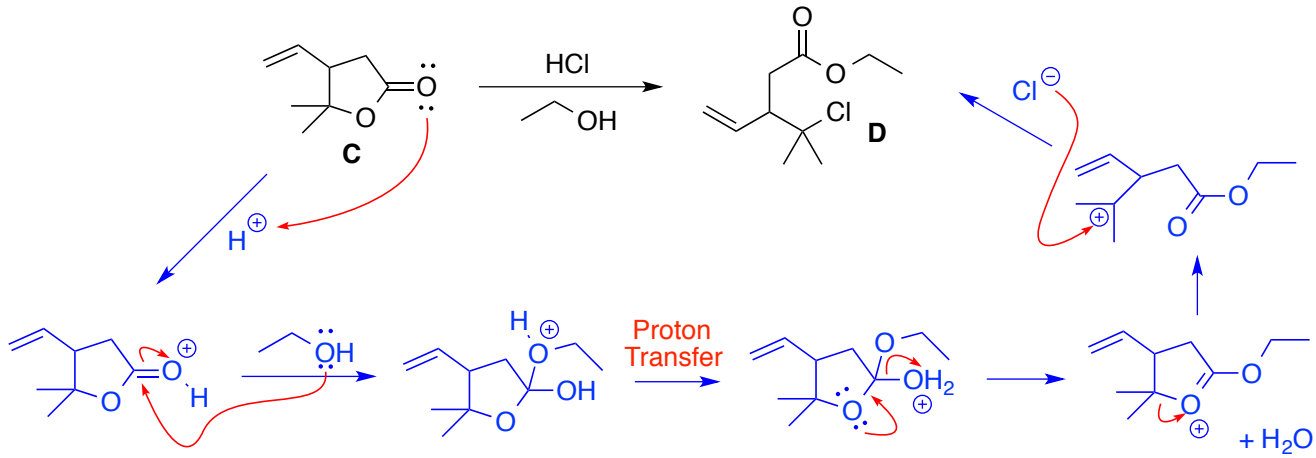


Adding acid to the reaction mixture would protonate the amine nitrogen which would make it non-nucleophilic and thus can no longer attack the carbonyl carbon leading to the amide product.

13) Draw the electron pushing mechanism for conversion of the bicyclic lactone (**A**) to carboxylic acid (**B**). Acid (**B**) is a key intermediate in the chemical synthesis of certain prostaglandins. *Note: this looks complex, but is an extremely simple mechanism if you keep track of your groups.*

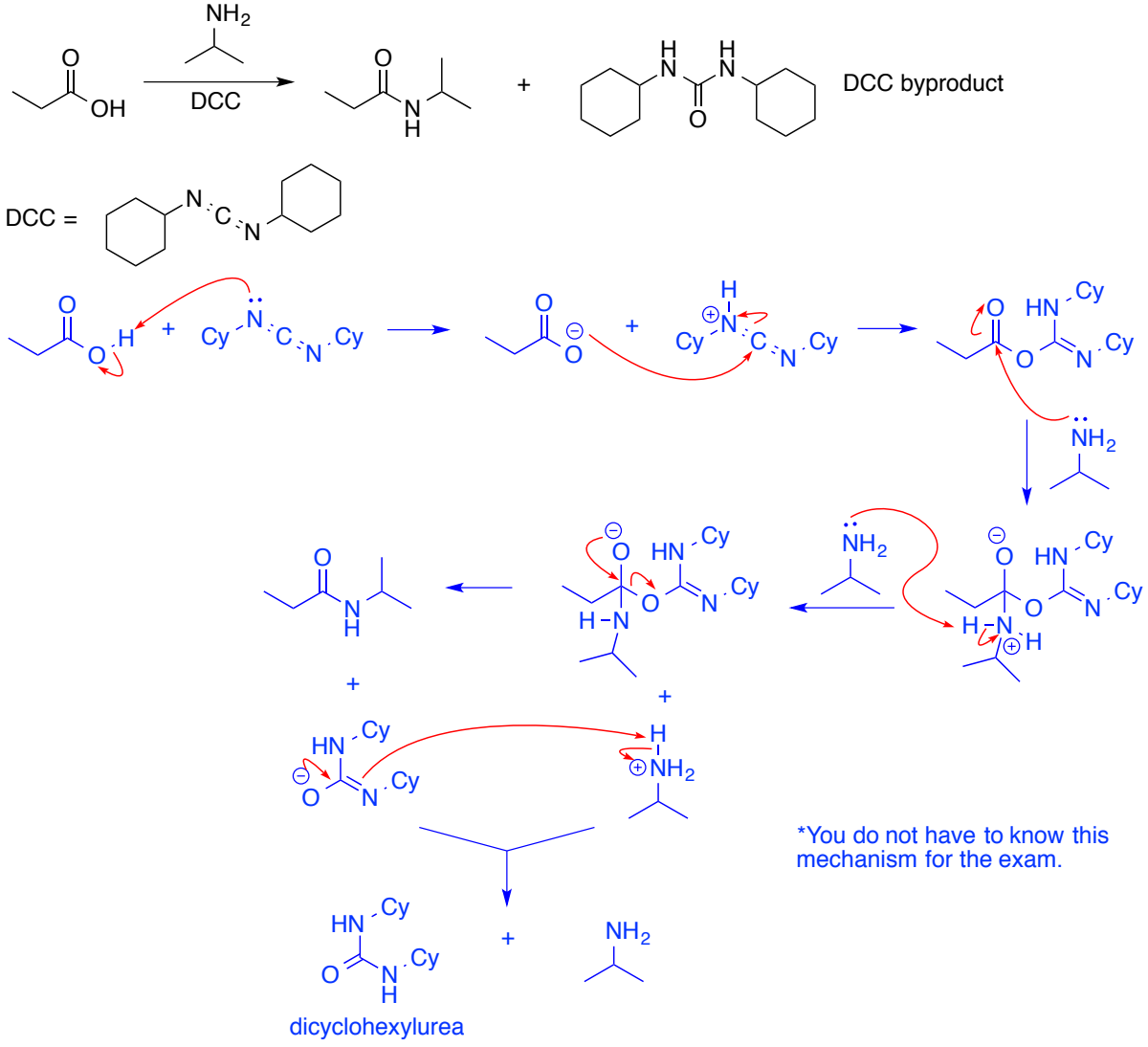


14) Draw the electron pushing mechanism to convert lactone (**C**) to ester (**D**). *Hint: an S_N1 reaction with water as your leaving group is involved at some point in the synthesis.*



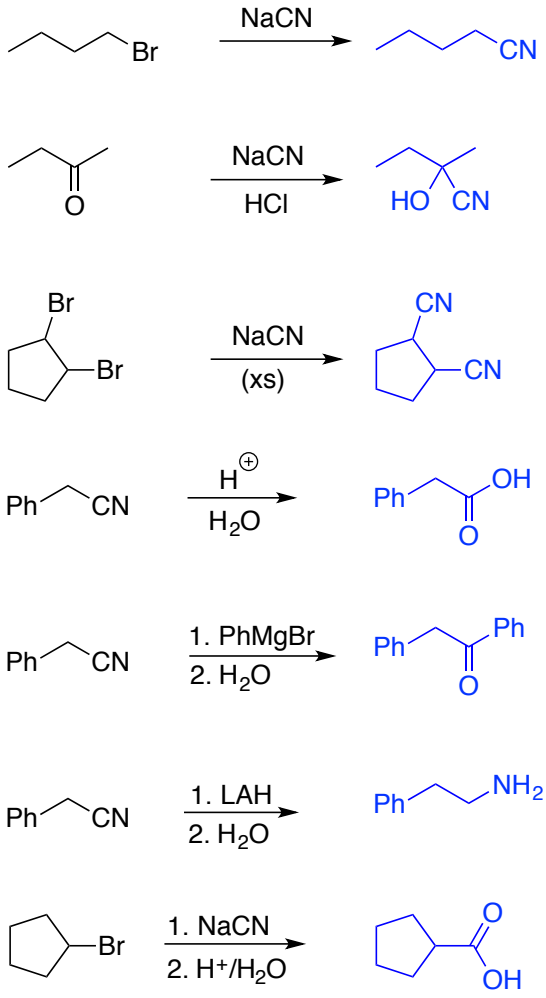
*There are a few different, but valid ways to draw out this mechanism.

15) Although we didn't discuss it in class, the mechanism for the DCC coupling is a relatively straightforward process (or maybe not). Draw the electron pushing mechanism for the reaction below.

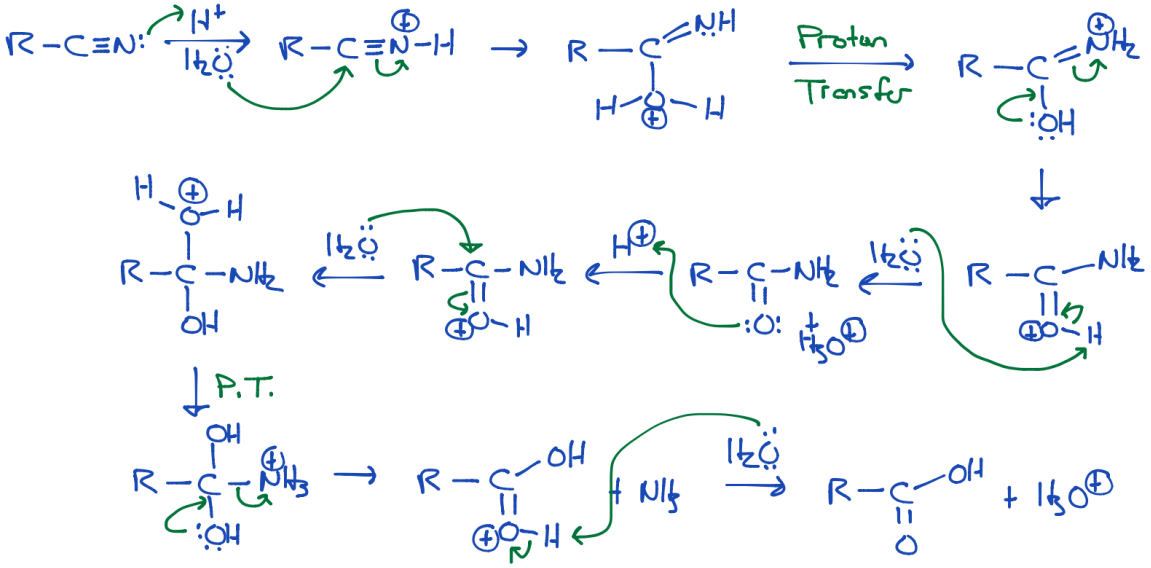


Nitrile Chemistry

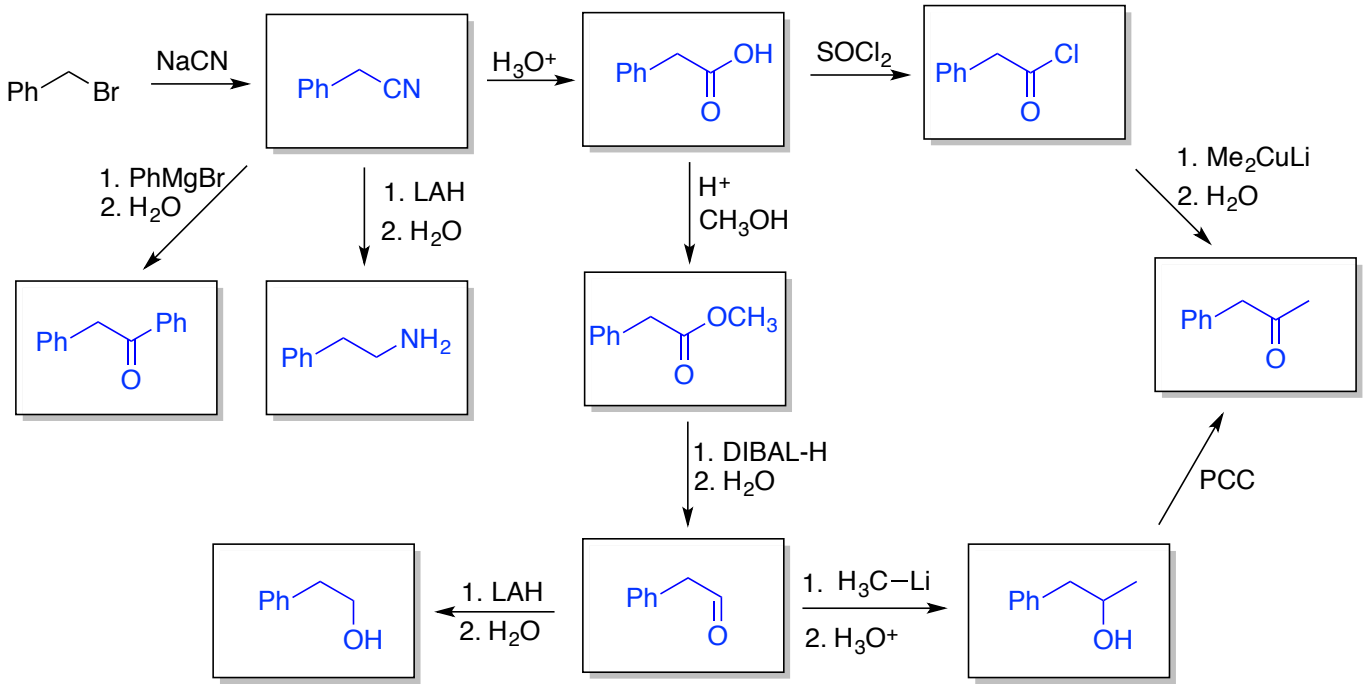
16) Predict the product for each reaction below.



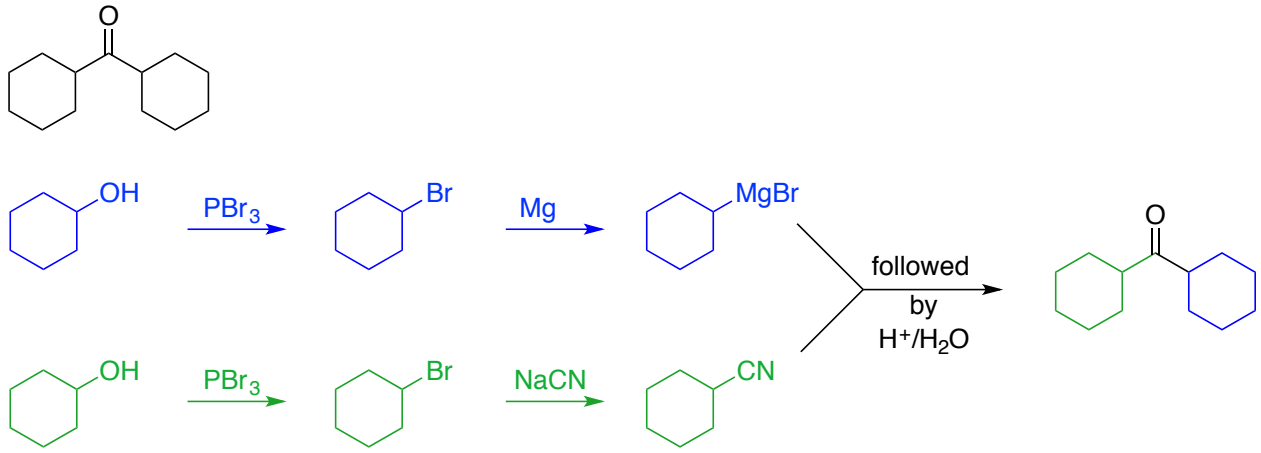
17) Draw the electron pushing mechanism for the acid mediated hydrolysis of a nitrile to a carboxylic acid. *Hint: The first step involves protonation of the nitrile nitrogen.*



18) Identify the missing compounds in the reaction scheme below.



19) Show how you could synthesize the compound below starting with two molecules of cyclohexanol and any other organic or inorganic reagents.



20) Show how the compound below could be synthesized starting with cyclopentanone.