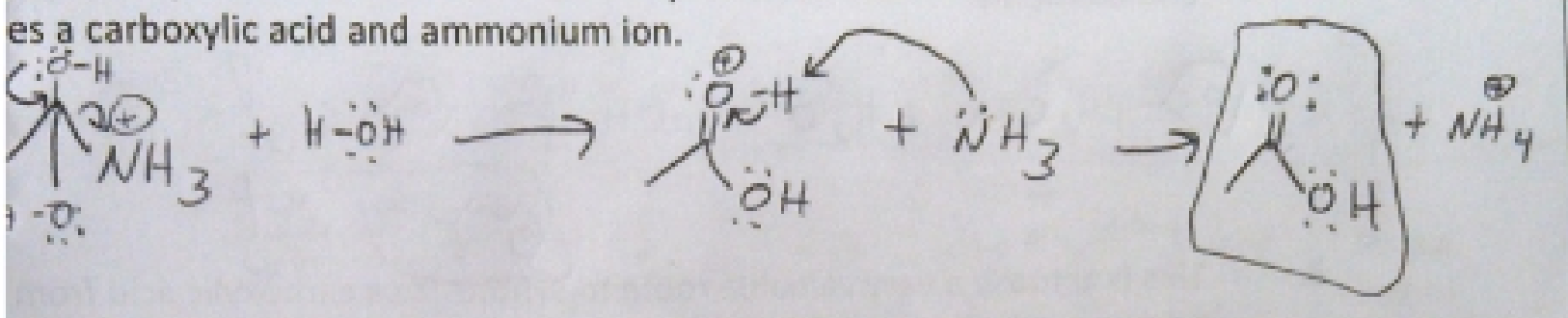


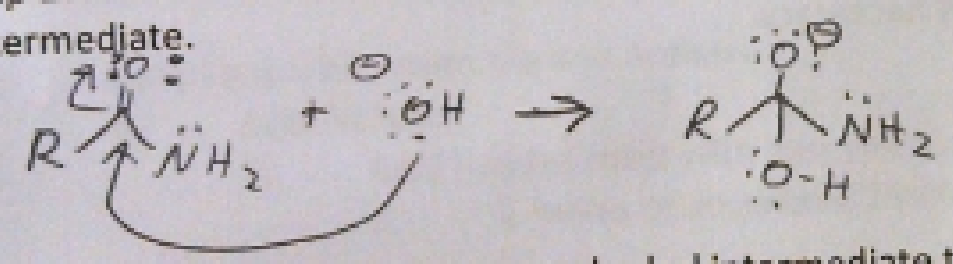
p 3: Collapse of the tetrahedral carbonyl addition intermediate followed by proton transfer gives a carboxylic acid and ammonium ion.



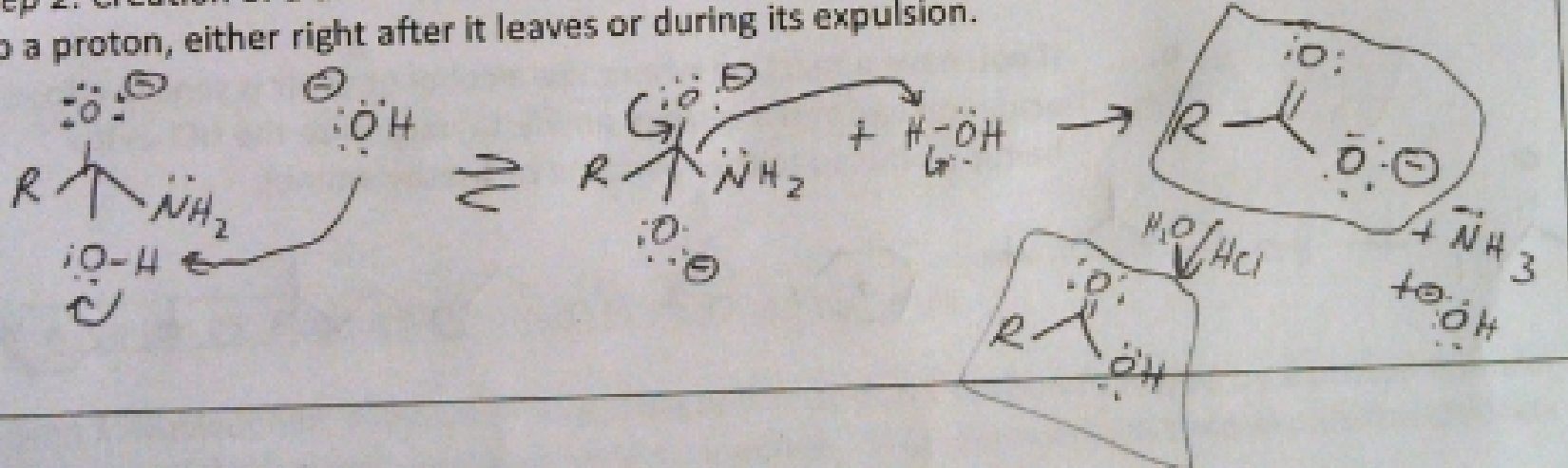
5. The mechanism for the hydrolysis of amides in base is a little more complex than the esters because the amide group is such a poor leaving group.

Mechanism #4: Hydrolysis of an Amide in Aqueous Base

Step 1: Addition of hydroxide ion to the carbonyl carbon gives a tetrahedral carbonyl addition intermediate.

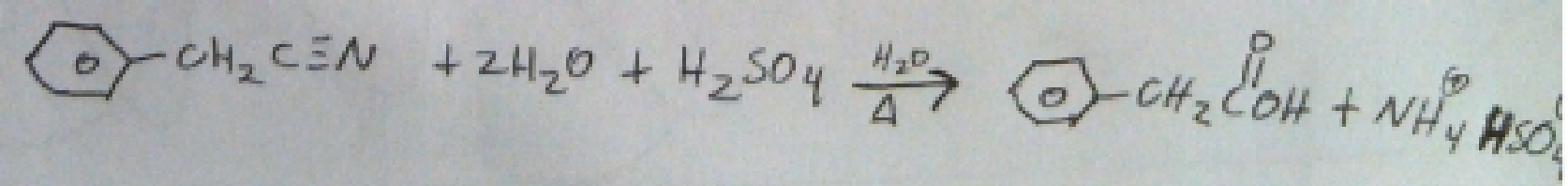


Step 2: Creation of a di-anionic tetrahedral intermediate that expels the amide ion. It will pick up a proton, either right after it leaves or during its expulsion.

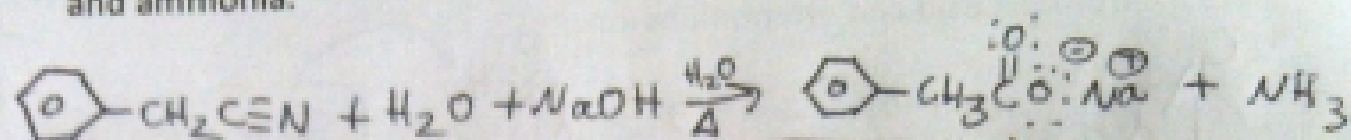


E. Nitriles

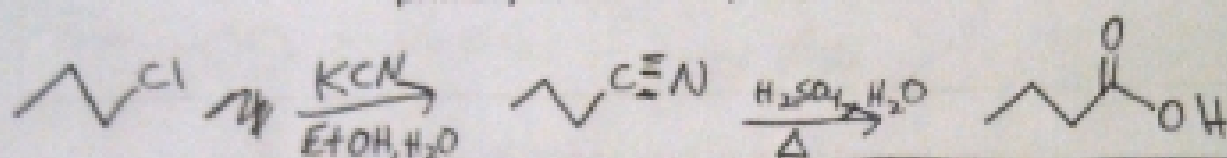
1. A cyano group is hydrolyzed in acid to form a carboxylic acid and ammonium ion.



2. Hydrolysis of a cyano group in aqueous base gives a carboxylate anion and ammonia.

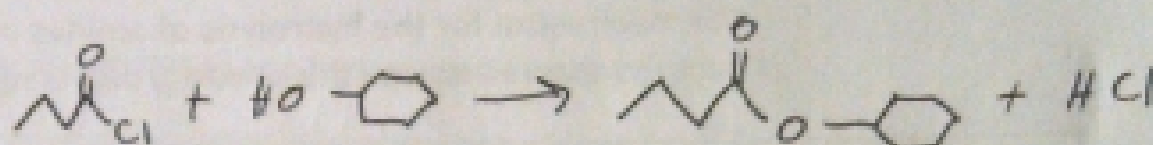


3. This is actually a very valuable route to synthesize a carboxylic acid from a primary or secondary alkyl halide.



V. Reactions with Alcohols

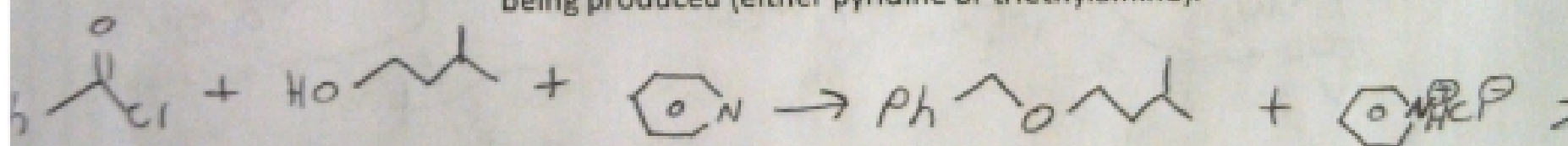
A. Acid Halides



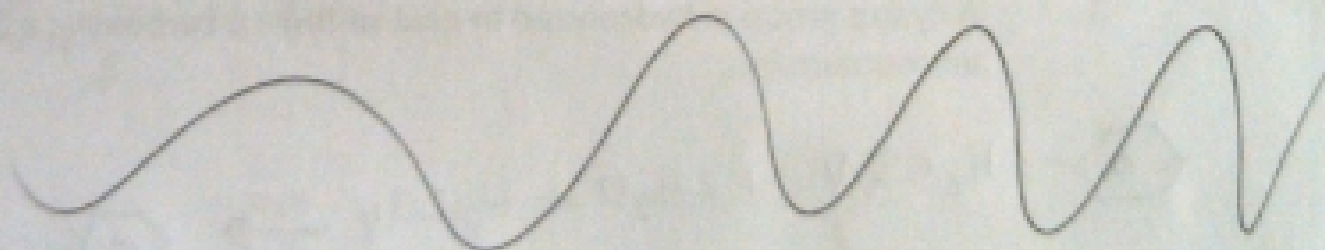
1. Acid halides react with alcohol to give an ester.

- a. Because they are so reactive towards most nucleophiles, no catalyst is necessary.

- b. If you have a reaction where the alcohol or ester is sensitive to acid, you can add a tertiary amine to neutralize the HCl as it's being produced (either pyridine or triethylamine).

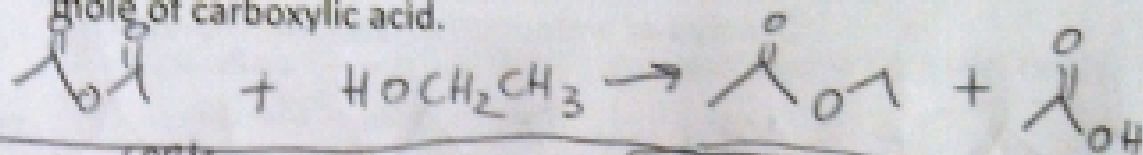


- c. Sulfonic acid esters are produced this way as well.



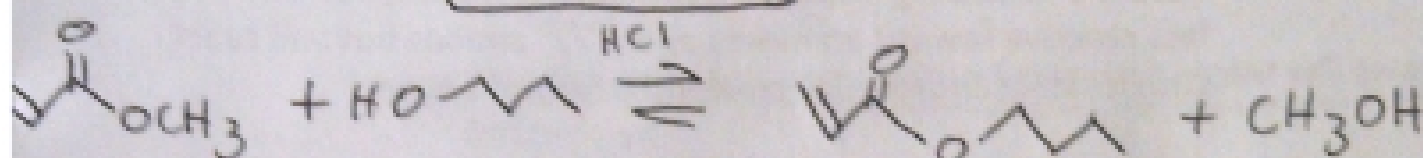
B. Acid Anhydrides

1. Acid anhydrides react with alcohols to give one mole of ester and one mole of carboxylic acid.



C. Esters

1. Esters react with alcohols in an acid-catalyzed reaction called transesterification.



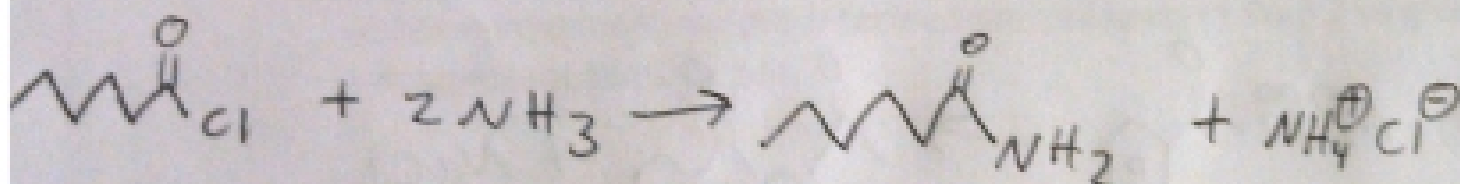
D. Amides

1. ~~Amides do not react with alcohols.~~

VI. Reactions with Ammonia and Amines

A. Acid Halides

1. Acid halides react with ammonia and 1°/2° amines to form amides.
a. 2 moles of ammonia/amine have to be used.



Mechanism #5: Reaction of Acetyl Chloride and Ammonia

Step 1: Nucleophilic addition of ammonia to the carbonyl carbon followed by a proton transfer gives a tetrahedral carbonyl addition intermediate. This intermediate then expels the chloride as a leaving group.

