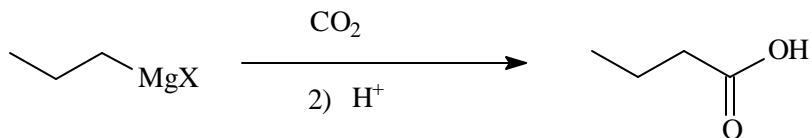


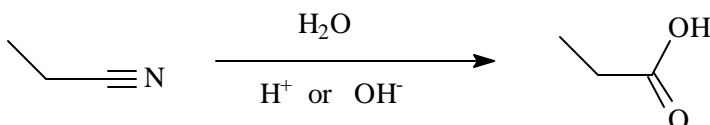
Carboxylic Acid Reactions

Preparation of Carboxylic Acids

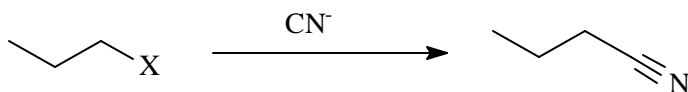
- 1) Oxidation of 1° alcohols with a strong oxidizer (see Alcohol reactions sheet)
- 2) Oxidation of alkyl side chains on benzene rings (see Benzene reactions sheet)
- 3) Grignard plus CO₂



- 2) Hydrolysis of a nitrile

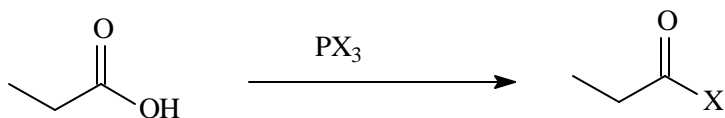
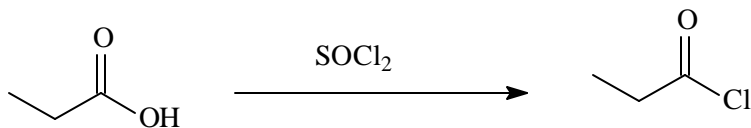


** To form a nitrile, react a 1° alkyl halide with the CN⁻ ion **



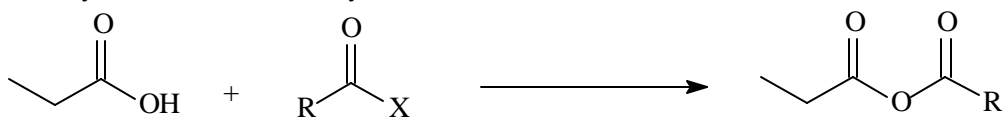
Preparation of acyl halides (acid chlorides and acid bromides)

- 1) React a carboxylic acid with SOCl₂, PBr₃, or PCl₃

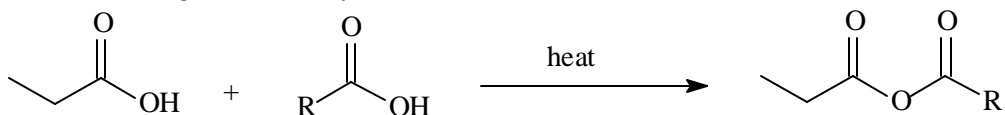


Preparation of acid anhydrides

- 1) React an acyl halide with a carboxylic acid

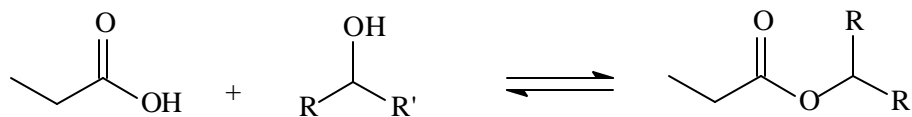


- 2) Dehydration (heating) of a carboxylic acid

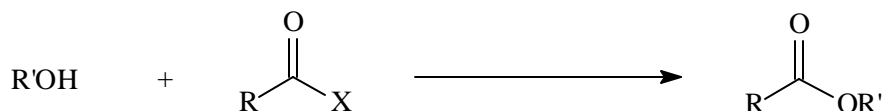
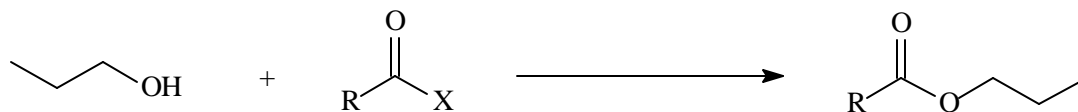


Preparation of Esters

1) Equilibrium reaction of a carboxylic acid and an alcohol (less desirable)



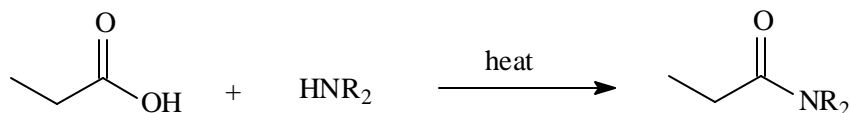
2) Reaction of an alcohol with an acid anhydride or acyl halide (desirable)



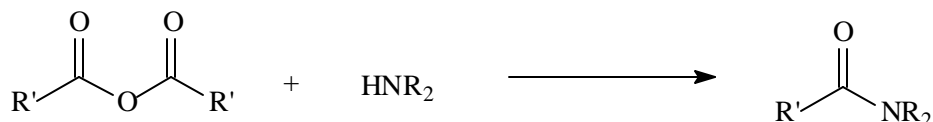
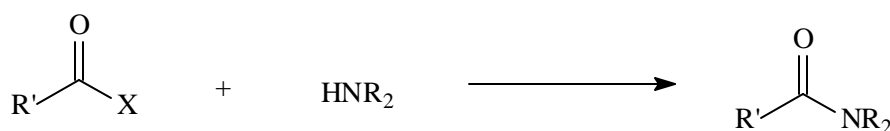
Preparation of Amides

(i.e amine)

1) Less desirable -- Heating a carboxylic acid with NH_3 /amine (the N group must have at least one H on it)



2) More desirable -- Reaction of NH_3 /amine with an acid anhydride or acyl halide (the amine must have an H)



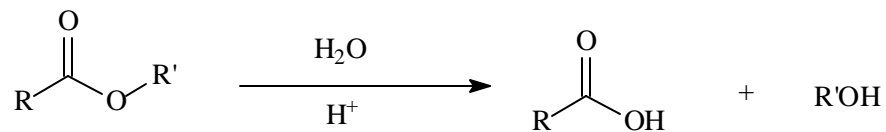
Reactions of Carboxylic Acids

1) Salt formation – reaction of a carboxylic acid with an alkali metal hydroxide (NaOH, LiOH, KOH)

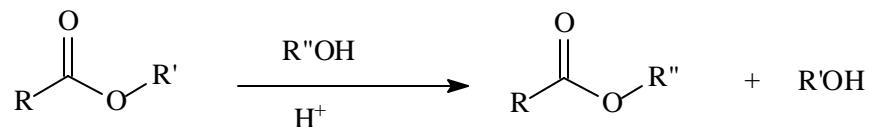


Reactions of Esters

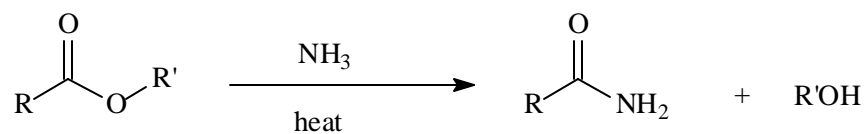
1) Hydrolysis



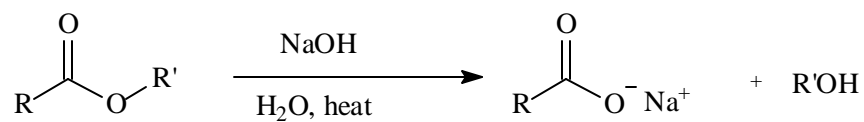
2) Transesterification



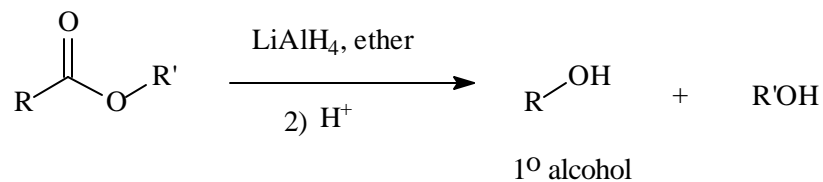
3) Ammonolysis



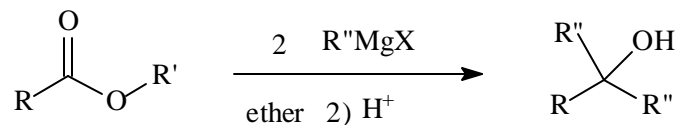
4) Saponification



5) Reduction – produces a primary alcohol

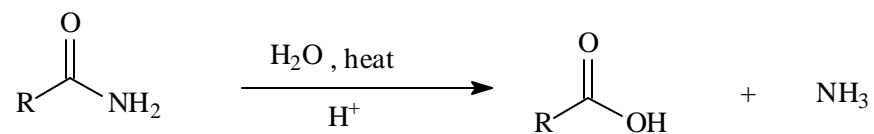


6) Grignard reaction – produces a tertiary alcohol

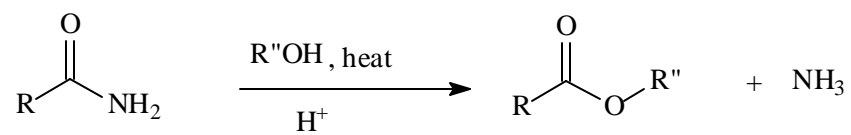


Reactions of Amides

1) Hydrolysis



2) Alcoholysis



3) Reduction – use LiAlH_4 to produce an amine

