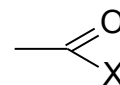


Acyl halides and acid anhydrides

General

Acyl halides are a group of compounds with a similar structure to aldehydes, but with a halide instead of the hydrogen (*right*, X = a halide). Acid anhydrides are formed when two carboxylic acids react and eliminate a molecule of water.



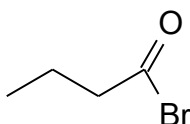
Both of these type of compounds are very reactive (acyl halides more than acid anhydrides) and are used for making a large number of other products.

Acyl halides

Naming acyl halides

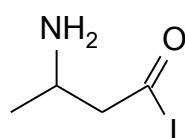
The normal naming rules apply but with an ending “oyl”. The halide name needs to be given as if they were part of an ionic compound (e.g. chloride, iodide and bromide).

As with aldehydes, acyl halides are terminal groups and the numbering of the carbons starts with the group.



Longest C chain : 4 = butan
Halide : bromine = bromide
Functional group : acyl halide

Full name : butanoyl bromide



Longest C chain : 4 = butan
Halide : iodine = iodide
Functional group : acyl halide
Other groups : amine on C 3

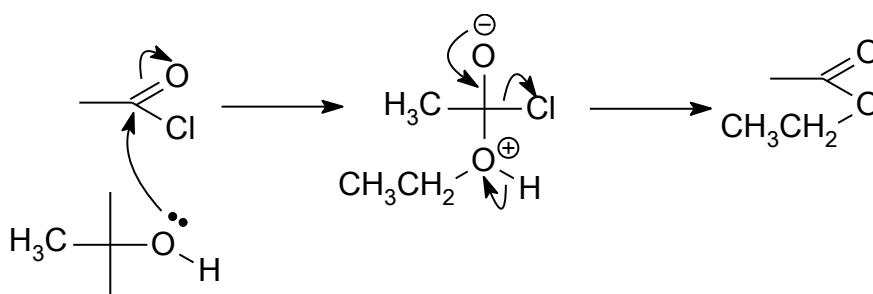
Full name : 3-amino butanoyl iodide

Reactions of acyl halides

Acyl halides undergo nucleophilic substitution reactions. They provide a simple route to adding nucleophiles to a chain without needing harsh reaction conditions. They readily react with water, alcohols, amines and ammonia.

When an acyl halide reacts, it is a very strong reaction with a large amount of heat given off. Care must be taken when being used. They are also usually hygroscopic (*attracts*

water) so are normally kept in inert (*unreactive*) atmosphere or where water is removed from the air.

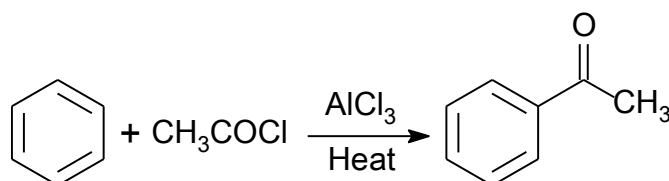


Here ethanoyl chloride is reacting with ethanoic acid to form ethyl ethanoate (an ester).

Acyl halide added to	Product
Ammonia	Amide
1° amide	Substituted amide
Water	Carboxylic acid

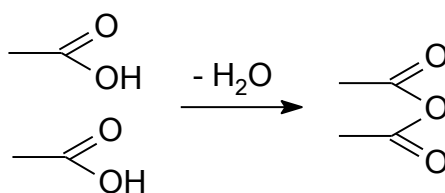
Friedel crafts acylation of benzene

The acylation of benzene (reacting benzene with an acyl halide) is a convenient method of adding an alkyl group to the benzene molecule. As it is a Friedel Crafts reaction, AlCl_3 is used as a catalyst to act as a proton acceptor molecule.



Acid anhydrides

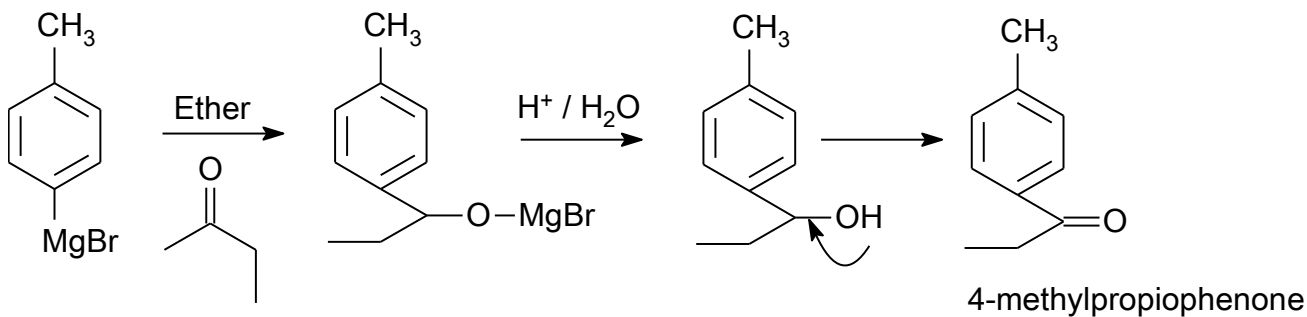
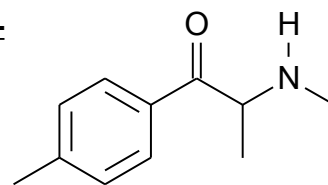
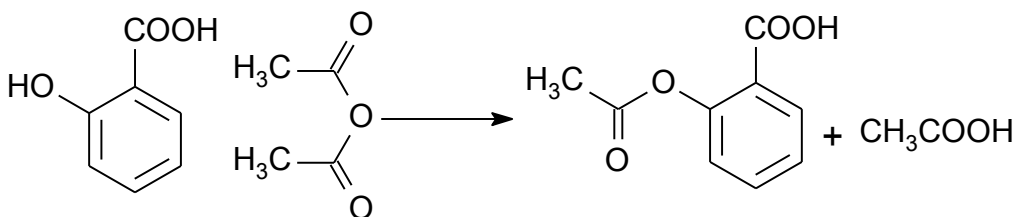
When two carboxylic acids react, a molecule of water is lost and an acid anhydride is formed (anhydride means without water)



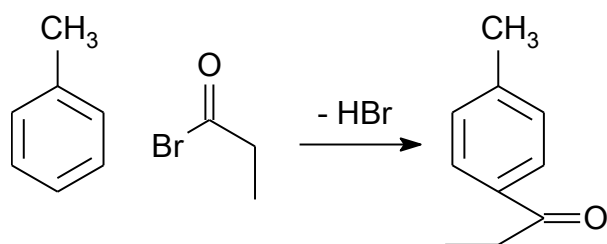
They readily attack a wide range of nucleophiles (such as water, amines, alcohols and ammonia) and are used in industry as they are far safer to use than acyl halides (they produce less heat and can be controlled easier)

Use in the production of drugs

Acyl halides and acid anhydrides are commonly used in the manufacture of drugs (be they legal or illegal). One of the simplest (and most common) drugs produced using an acid anhydride is aspirin.



number of steps and therefore increases profit. The end product of the Grignard mechanism shown can be achieved in one step



While the final steps are the same as for the Grignard route, the process has halved the number of steps required via the Grignard and reduced the safety problems involved in the production considerably.

