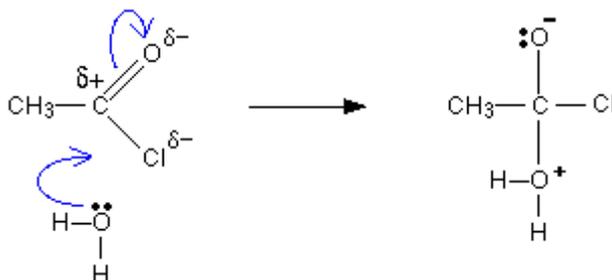


## Chemguide – questions

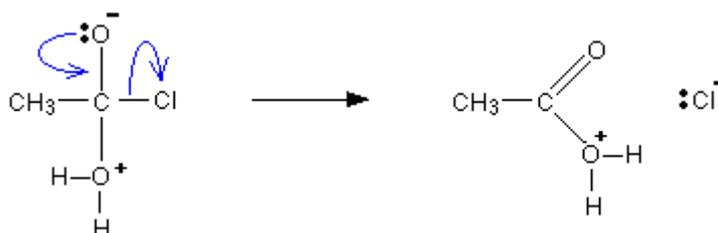
### ADDITION / ELIMINATION REACTIONS

1. Ethanoyl chloride,  $\text{CH}_3\text{COCl}$ , a typical acyl chloride, reacts instantly with water to produce ethanoic acid and fumes of hydrogen chloride. The mechanism for the reaction is as follows:

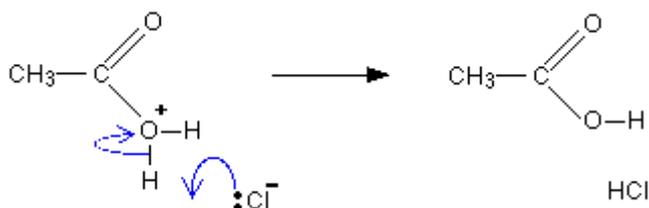
Stage 1:



Stage 2:



Stage 3:



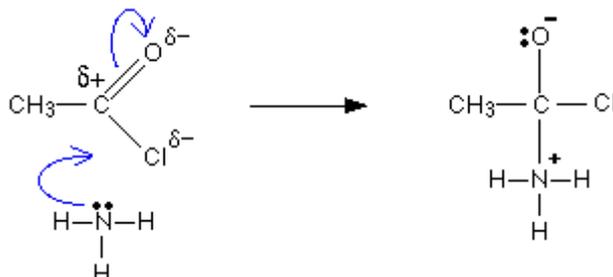
- a) In stage 1, the water is acting as a nucleophile. What is a nucleophile, and why is water a nucleophile?
- b) Describe and explain what is happening at each stage of this mechanism.
- c) Ethanol has the formula  $\text{CH}_3\text{CH}_2\text{OH}$ . Write the equation for the reaction between ethanoyl chloride and ethanol, and name the organic product.
- d) Explain why you might expect ethanol to behave as a nucleophile in a similar way to water.
- e) Write the full mechanism for the reaction between ethanoyl chloride and ethanol.

## Chemguide – questions

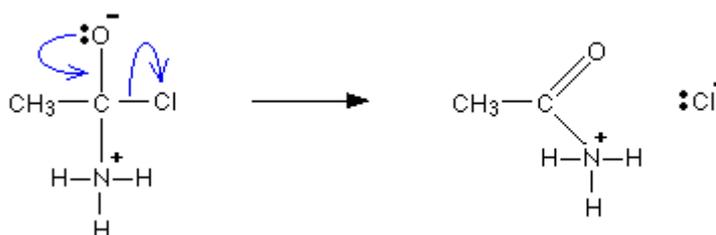
2. If you add drops of ethanoyl chloride to a concentrated solution of ammonia in the cold, there is a violent reaction, and you get a white solid mixture of ethanamide and ammonium chloride.

The mechanism for the reaction is

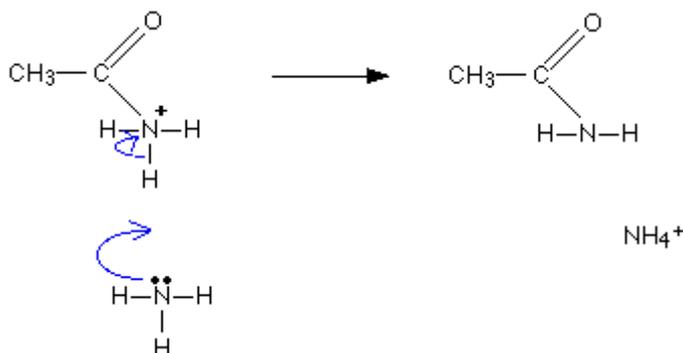
Stage 1:



Stage 2:



Stage 3:



a) Write the overall equation for the reaction.

b) Describe and explain what is happening at each stage of the mechanism.

c) Stage 3 of the mechanism could happen differently with the hydrogen ion being removed by a chloride ion to produce HCl – followed by the formation of ammonium chloride from the HCl and excess ammonia in the mixture. Draw the mechanism for stage 3 involving a chloride ion. Include the equation for the final formation of ammonium chloride.

d) Write the mechanism for the reaction between ethanoyl chloride and ethylamine, CH<sub>3</sub>CH<sub>2</sub>NH<sub>2</sub>, to form a mixture of N-ethylethanamide and ethylammonium chloride. (Note: Don't be scared by the names! If you work through the mechanism, you will automatically get the right products formed.)