

CAIE Chemistry A-level

Topic 33 - Carboxylic Acids and Derivatives

(A level only)

Flashcards

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How do carboxylic acids react to form acyl chlorides?



How do carboxylic acids react to form acyl chlorides?

Carboxylic acids react with sulfur dichloride oxide to form an acyl chloride, sulfur dioxide and hydrogen chloride.



What is the chemical equation for the reaction between ethanoic acid and sulfur dichloride oxide?



What is the chemical equation for the reaction between ethanoic acid and sulfur dichloride oxide?



How is methanoic acid further oxidised?



How is methanoic acid further oxidised?

Although methanoic acid is a carboxylic acid, it also has an aldehyde functional group. This means the aldehyde group can be oxidised further by using Tollens' reagent or Fehling's solution.

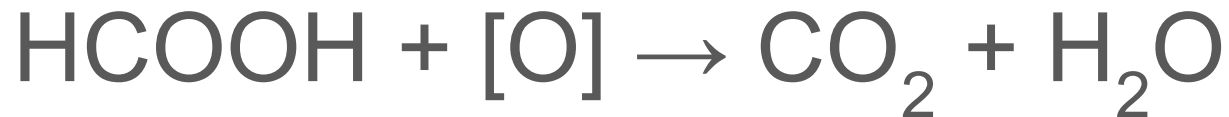
Methanoic acid is oxidised to carbon dioxide and water.



What is the chemical equation for the oxidation of methanoic acid?



What is the chemical equation for the oxidation of methanoic acid?



How is ethanedioic acid oxidised further?



How is ethanedioic acid oxidised further?

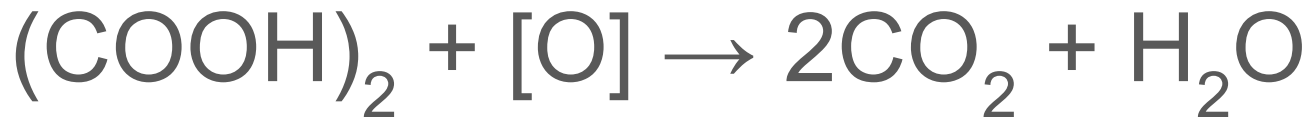
Ethanedioic acid is oxidised to carbon dioxide and water using warm acidified potassium manganate(VII) solution.



What is the chemical equation for the oxidation of ethanedioic acid?



What is the chemical equation for the oxidation of ethanedioic acid?



State the relative acidities of carboxylic acids, alcohols and phenols



State the relative acidities of carboxylic acids, alcohols and phenols

Carboxylic acids → Phenol → Alcohols
→ Decreasing acidity →



Explain the relative acidities of carboxylic acids, alcohols and phenols



Explain the relative acidities of carboxylic acids, alcohols and phenols

- Carboxylic acids are the most acidic as the carboxylate ion has a delocalised pi system that develops over the -COO^- group. This distributes the negative charge, making the carboxylate ion more stable.
- Phenols are more acidic than alcohols because the the phenoxide ion is relatively stable. The lone pair on the oxygen is delocalised into the pi system so the negative charge is dispersed. This makes phenol more likely to donate a hydrogen ion compared with alcohols.
- Alcohols are the least acidic because of the positive inductive effect. In the alkoxide ion, the alkyl groups “push” electrons away from themselves, increasing the electron density of the oxygen, making it more likely to bond to a hydrogen ion and reform an alcohol.



What determines the acidity of chlorine substituted ethanoic acids?



What determines the acidity of chlorine substituted ethanoic acids?

You can strengthen an acid by pulling charge away from the -COO^- end. This can be done by adding a chlorine atom to the chain. Chlorine is very electronegative and so will have a tendency to attract electrons towards itself.

Therefore, the more chlorines bonded, the stronger the acid.



How do acyl chlorides react with water?



How do acyl chlorides react with water?

Hydrolysis reaction:

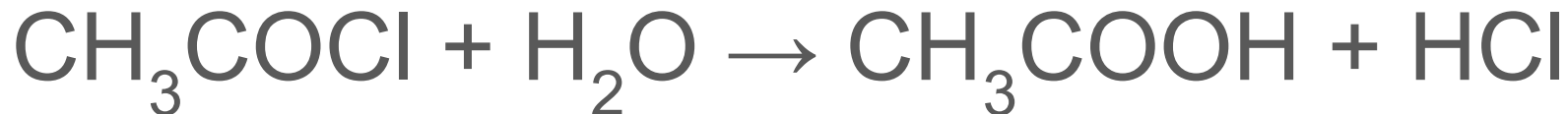
The acyl chloride reacts with water to form a carboxylic acid and hydrochloric acid.



What is the chemical equation for the hydrolysis of ethanoyl chloride?



What is the chemical equation for the hydrolysis of ethanoyl chloride?



How do acyl chlorides react with alcohols?



How do acyl chlorides react with alcohols?

Acyl chlorides react with alcohols to form an ester and hydrochloric acid:



How do acyl chlorides react with phenol?



How do acyl chlorides react with phenol?

An acyl chloride reacts with phenol to form an aromatic ester and hydrochloric acid.

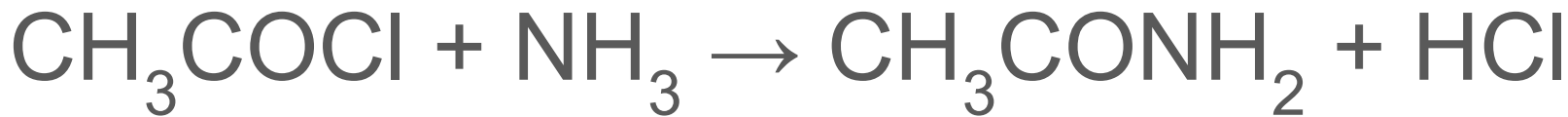


How do acyl chlorides react with ammonia?



How do acyl chlorides react with ammonia?

Acyl chlorides react with ammonia to form a primary amide and hydrochloric acid:



How do acyl chlorides react with a primary amine?



How do acyl chlorides react with a primary amine?

Acyl chlorides react with a primary amine to form a secondary amide and hydrochloric acid:



Compare the relative ease of hydrolysis of acyl chlorides, alkyl chlorides and aryl chlorides



Compare the relative ease of hydrolysis of acyl chlorides, alkyl chlorides and aryl chlorides

- Acyl chlorides react vigorously with cold water to produce a carboxylic acid and hydrogen chloride gas.



- Alkyl chlorides have almost no reaction with water.
- Aryl chlorides have no reaction with water.



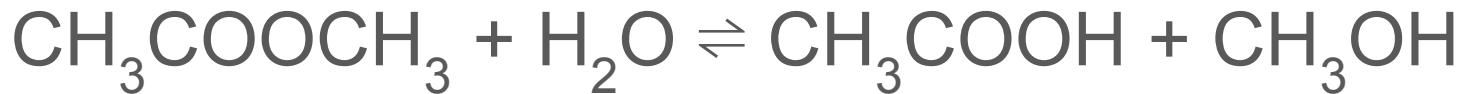
How do esters undergo acid hydrolysis?



How do esters undergo acid hydrolysis?

Heat the ester under reflux with dilute aqueous acid. The ester will be hydrolysed into a carboxylic acid and alcohol.

The reaction is slow and reversible.



How do esters undergo base hydrolysis?



How do esters undergo base hydrolysis?

Heat the ester under reflux with a dilute alkali. The ester will be hydrolysed into the salt of the carboxylic acid, and the alcohol. The reaction is one-way and faster than acid hydrolysis.

