

# OCR (A) Chemistry A-level

## Topic 6.1.3 - Carboxylic Acids and Esters

### Flashcards

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# What is the functional group of a carboxylic acid?



What is the functional group of a carboxylic acid?

-COOH (C=O and C-OH)



# How do you name carboxylic acids?



# How do you name carboxylic acids?

-oic acid



Are carboxylic acids soluble  
in water? Why? What  
influences their solubility.



Are carboxylic acids soluble in water? Why? What influences their solubility

Yes. Acid group can form hydrogen bonds with water molecules



# What are the intermolecular forces in carboxylic acids?





# What are the intermolecular forces in carboxylic acids?

Hydrogen bonds in solid state - very strong.



What are esters (what are they formed from)? Functional group, general formula?



What are esters (what are they formed from)?

Functional group, general formula?

Formed from carboxylic acids and alcohols.

$\text{RCOOR}'$  ( $\text{C}=\text{O}$ ,  $\text{C}-\text{O}-\text{C}$ )



Write an equation for the  
reaction of ethanoic acid  
with propan-1-ol



Write an equation for the reaction of ethanoic acid with propan-1-ol



# How do you name esters?



# How do you name esters?

Start with the alcohol group that has replaced the hydrogen, then acid part e.g. propyl (from alcohol) ethanoate (from carboxylic acid).



# What characteristic physical properties do esters have?





What characteristic physical properties do esters have?

Volatile, pleasant fruity smells e.g. apple, pear drops



# What are some uses of esters?



# What are some uses of esters?

Flavourings, perfumes (both for longer chains), solvents (short chains), plasticisers.





How could you distinguish  
carboxylic acids from other  
-OH containing  
compounds?



How could you distinguish carboxylic acids from other -OH containing compounds?

Add  $\text{NaHCO}_3$ , acids will produce sodium salt, water and carbon dioxide.



Write an equation for the reaction of ethanoic acid with NaOH.



Write an equation for the reaction of ethanoic acid with NaOH.



Write an equation for the  
reaction of ethanoic acid  
with  $\text{Na}_2\text{CO}_3$ .





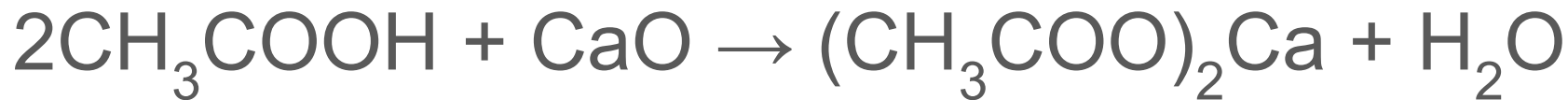
Write an equation for the reaction of ethanoic acid with  $\text{Na}_2\text{CO}_3$ .



Write an equation for the reaction of ethanoic acid with calcium oxide



Write an equation for the reaction of ethanoic acid with calcium oxide



What catalyst is needed for the formation of esters from alcohols and carboxylic acids?



What catalyst is needed for the formation of esters from alcohols and carboxylic acids?

Concentrated strong acid e.g.  $\text{H}_2\text{SO}_4$



# What catalyst is needed for the hydrolysis of esters?



What catalyst is needed for the hydrolysis of esters?

Dilute strong acid e.g.  $\text{H}_2\text{SO}_4$



# What is an alternative method of hydrolysis?





# What is an alternative method of hydrolysis?

## Base hydrolysis



# What are the advantages of base hydrolysis?



# What are the advantages of base hydrolysis?

Reaction goes to completion due to neutralisation by base - more product in the mixture than acid catalysed hydrolysis.



# What are carboxylic acid derivatives?



# What are carboxylic acid derivatives?

Molecules that have the acyl group as part of their structure, formed from carboxylic acids



Name two acid derivatives  
and give their functional  
groups.



Name two acid derivatives and give their functional groups.

Acyl chlorides:  $\text{RCOCl}$

Acid anhydrides:  $\text{RCOOCR} / (\text{RCO})_2\text{O}$



# How do you form an acyl chloride?





How do you form an acyl chloride?

React a carboxylic acids with  $\text{SOCl}_2$

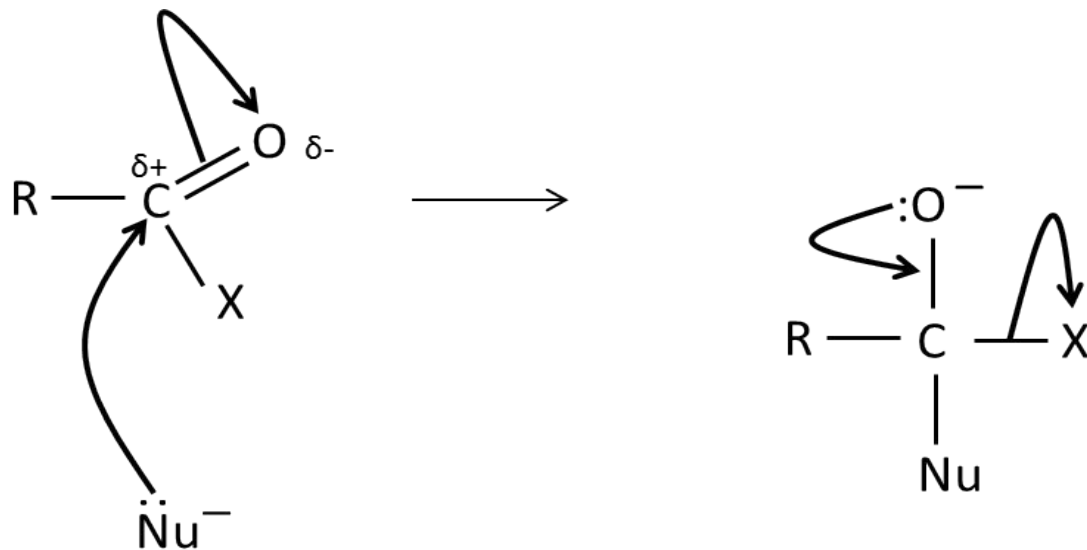


Draw the mechanism for the acylation of a nucleophile by an acid derivative.





Draw the mechanism for the acylation of a nucleophile by an acid derivative.



If the nucleophile is ammonia for the acylation of acyl chlorides or acid anhydrides, what are the products of the reaction?



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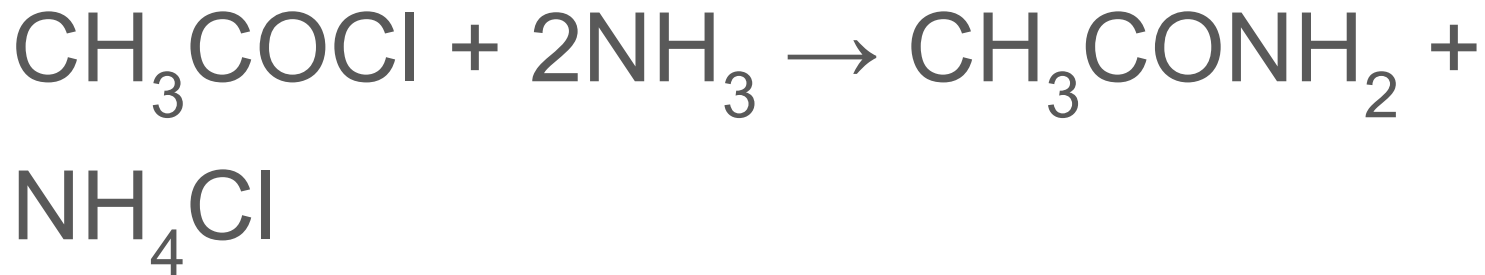
An amide



Write an equation for the reaction of ethanoyl chloride and ammonia.



Write an equation for the reaction of ethanoyl chloride and ammonia



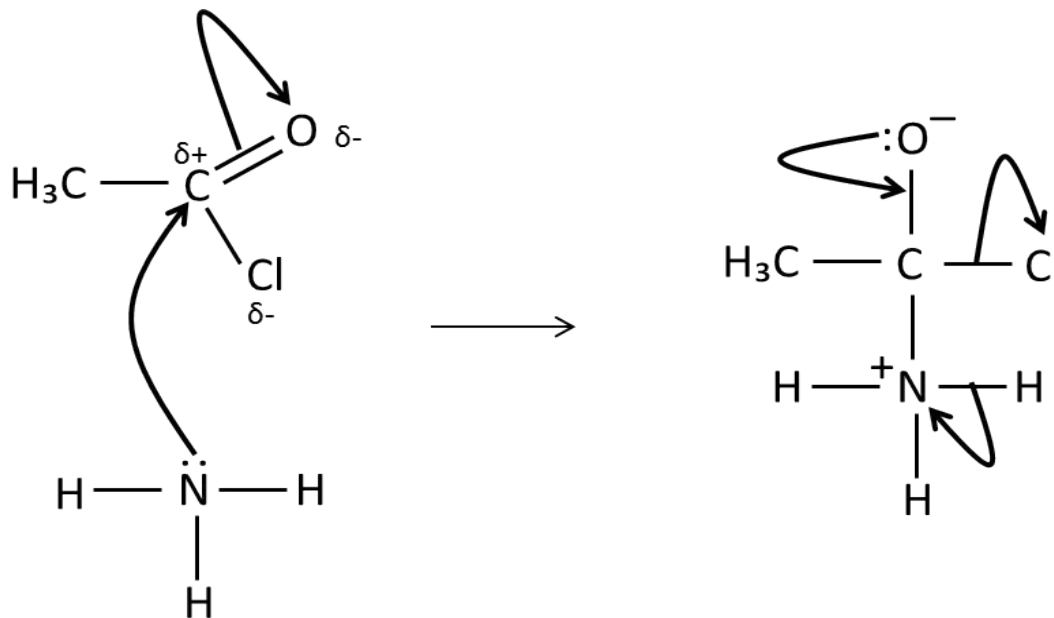
Draw the mechanism for the reaction of ethanoyl chloride and ammonia.







# Draw the mechanism for the reaction of ethanoyl chloride and ammonia



If the nucleophile is a primary amine, what are the products of the acylation of acyl chlorides or acid anhydrides?



If the nucleophile is a primary amine, what are the products of the acylation of acyl chlorides or acid anhydrides?

N-substituted amide



Write an equation for the  
reaction of ethanoyl chloride  
and methylamine



Write an equation for the reaction of ethanoyl chloride and methylamine

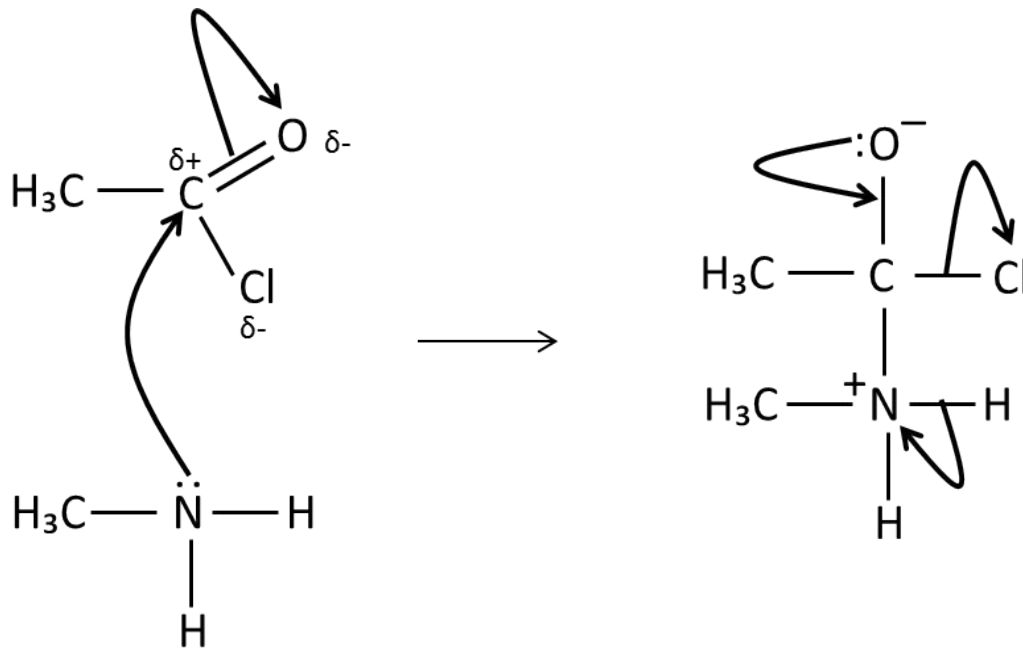


Draw the mechanism for the reaction of ethanoyl chloride and methylamine.





Draw the mechanism for the reaction of ethanoyl chloride and methylamine.



If the nucleophile is an alcohol, what are the products of the acylation of acyl chlorides or acid anhydrides?





If the nucleophile is an alcohol, what are the products of the acylation of acyl chlorides or acid anhydrides?

An ester



Write an equation for the reaction of ethanoyl chloride and ethanol.



Write an equation for the reaction of ethanoyl chloride and ethanol

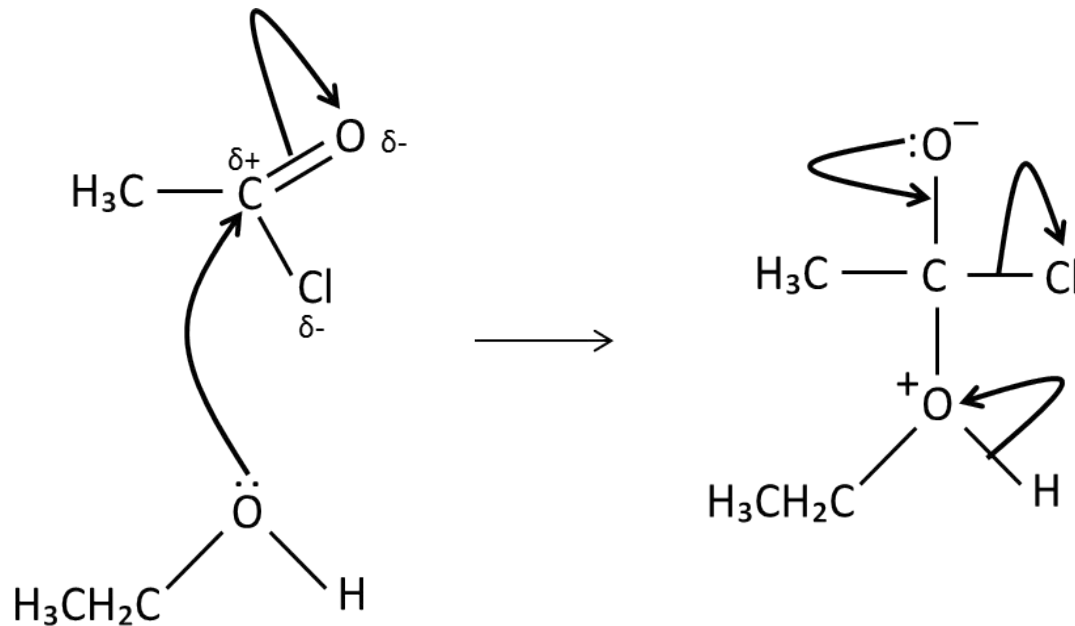


Draw the mechanism for the reaction of ethanoyl chloride and ethanol.





# Draw the mechanism for the reaction of ethanoyl chloride and ethanol



If the nucleophile is water,  
what are the products of the  
acylation of acyl chlorides or  
acid anhydrides?



If the nucleophile is water, what are the products of the acylation of acyl chlorides or acid anhydrides?

Carboxylic acid (hydrolysis produces an ester linkage)



What is the name of this reaction (the acylation of acyl chlorides/acid anhydrides with water as a nucleophile)?





What is the name of this reaction (the acylation of acyl chlorides/acid anhydrides with water as a nucleophile)?

hydrolysis



Write an equation for the reaction of ethanoyl chloride and water..



Write an equation for the reaction of ethanoyl chloride and water.



Draw the mechanism for the reaction of ethanoyl chloride and water.





Draw the mechanism for the reaction of ethanoyl chloride and water.

