

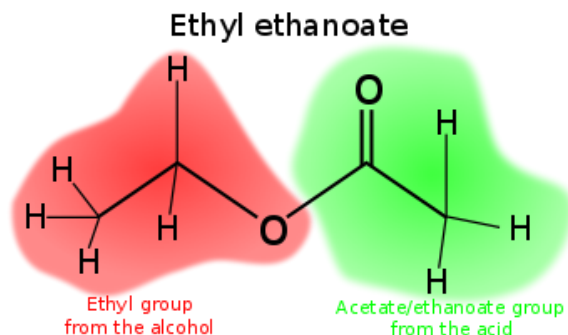
Level 3 Science 90730 Describe selected organic compounds and their uses.

Esters!

What is an Ester?

It is a type of compound formed when an alcohol reacts with a carboxylic acid.

This type of reaction is called a condensation reaction (a small molecule is released when the ester bond is made) or just straight forward “esterification”. In the reaction between an –OH (alcohol) group and –COOH (carboxylic acid group) the small molecule will be water (H₂O).



How are they made?

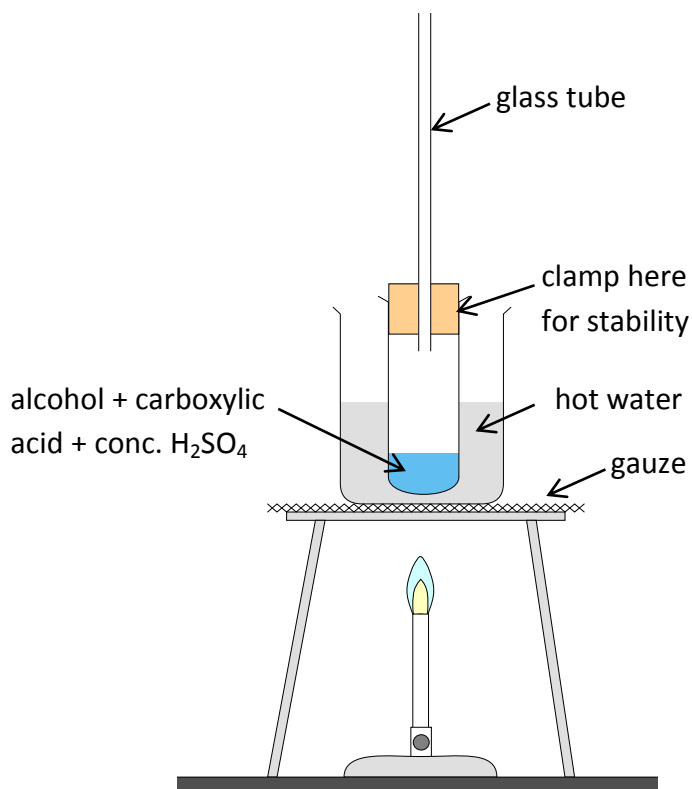
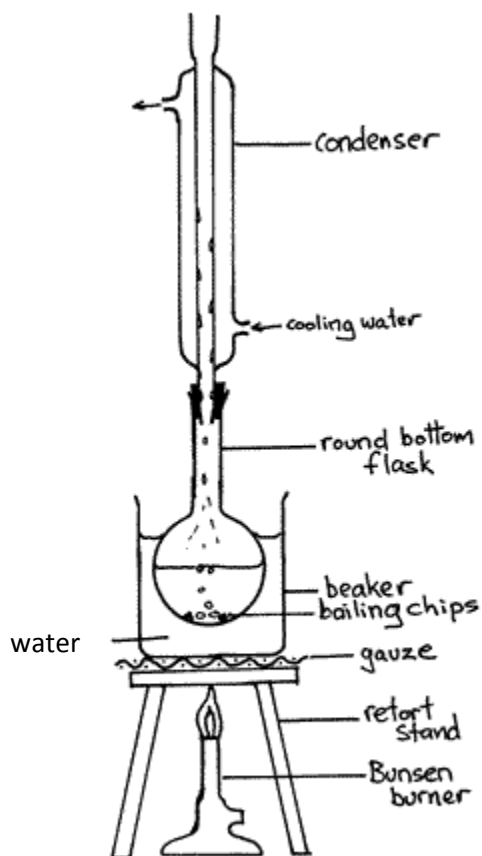
In the laboratory a primary alcohol (one with its –OH stuck on the end of the chain) reacts with a carboxylic acid. An equilibrium reaction is set up and it takes a long time for it to reach equilibrium. To speed things up (increase the reaction rate) we use a water bath (remember the reactants and organic product are flammable) but this won't shift the position of equilibrium in favour of the forward reaction (to make ester). To do this we add a small amount (few drops) of concentrated sulfuric acid. This acts as a catalyst as well as absorbing the water which results in more reactants forming ester product.

In a laboratory this will take less than 5 minutes.

Esters are volatile (vapourise easily) and so an air condenser can be used, or the more expensive Liebig condenser. Both work by cooling the reactant and product vapours so that they condense and fall back into the reaction container. This also helps to increase the yield of ester as well as reducing the fire risk!

See the next page for suitable diagrams.

Apparatus



Expensive method vs cheap method!

Don't forget to **neutralise** the unreacted carboxylic acid and the sulfuric acid by pouring the contents of the flask/boiling tube into a solution of **sodium hydrogen carbonate** or **sodium carbonate**. Colourless bubbles of carbon dioxide gas are given off and the sharp "acidic" vapours are replaced by the smell of ester – which forms an oily layer on the surface as it is not soluble in water.

