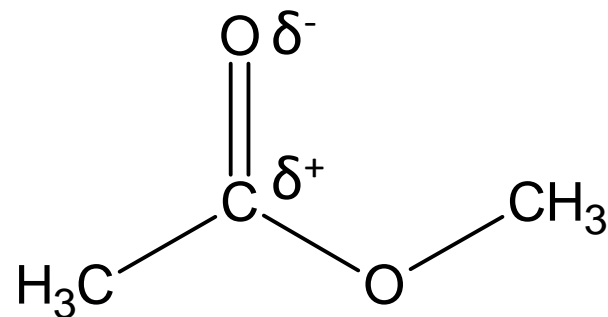


Esters

What intermolecular forces do you think esters have?

How will these intermolecular forces affect their:

- Melting and boiling points compared to alkanes
- Solubility in water

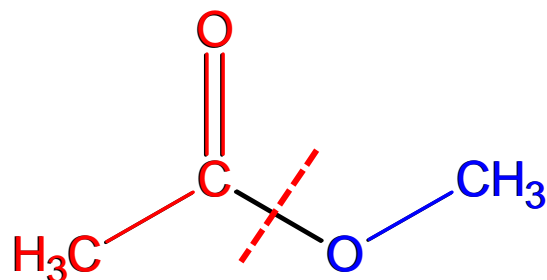


Dipole-dipole intermolecular forces but not hydrogen bonding, two non-polar carbon chains surrounding the dipole $\text{C}=\text{O}$.

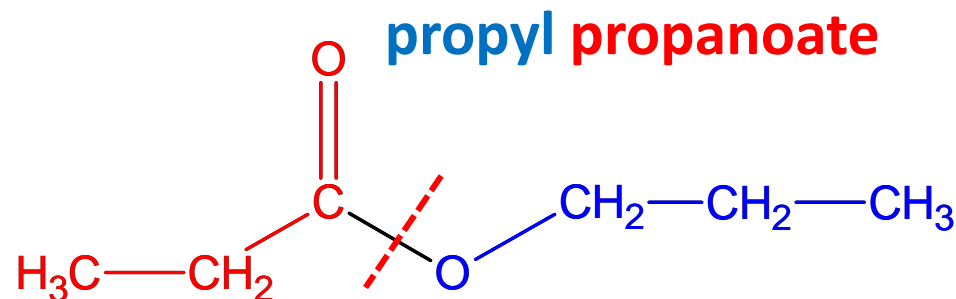
Naming esters

Esters have a two part name. The first part of the name comes from the **alcohol** that it was made from, and has a suffix of **-yl**. The second part of the name comes from the **carboxylic acid** that it was made from, and has a suffix of **-anoate**.

For example:



methyl ethanoate



propyl propanoate

What is the alcohol that this ester was made from? **methanol**

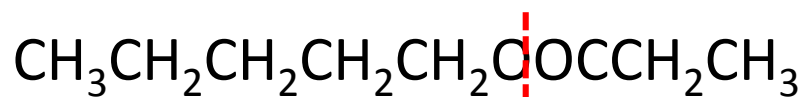
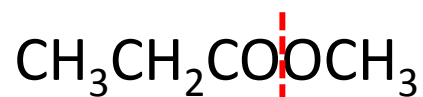
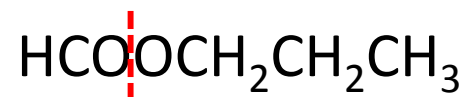
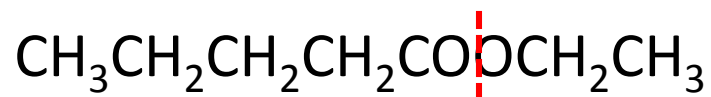
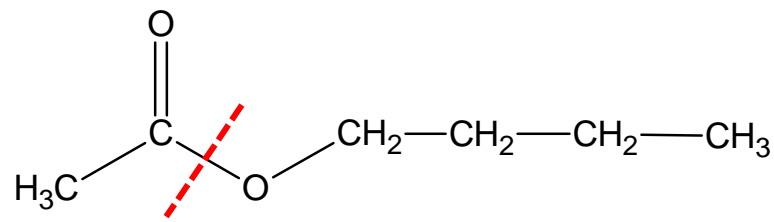
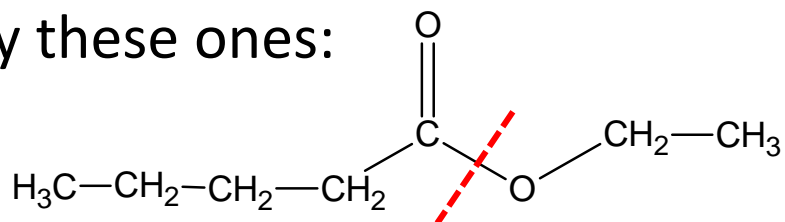
What is the carboxylic acid that this ester was made from?

ethanoic acid

Naming esters

Esters have a two part name. The first part of the name comes from the **alcohol** that it was made from, and has a suffix of **-yl**. The second part of the name comes from the **carboxylic acid** that it was made from, and has a suffix of **-anoate**.

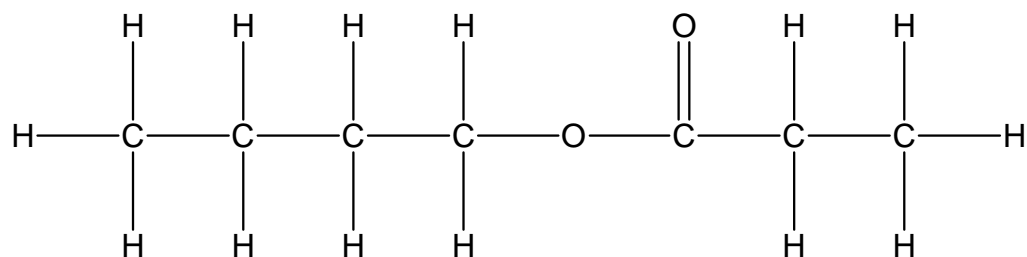
Try these ones:



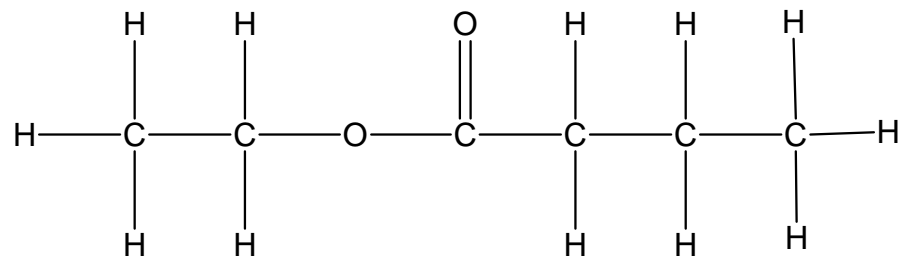
Do now

Get out your homework

Name and draw the following esters



methyl pentanoate



Making esters

How could you prepare a sample of ethyl propanoate?

- By heating ethanol and propanoic acid with a small amount of conc. H_2SO_4
- By heating ethanol and propanoyl chloride together.

What alcohol and carboxylic acid could be used to form the following esters?

Butyl methanoate

Ethyl ethanoate

Propyl methanoate

Methyl butanoate

Write equations for the following reactions using structural formula.

Propan-1-ol and propanoic acid with a little H_2SO_4

Pentanoyl chloride with ethanol

2-methylpropan-2-ol and propanoic acid with a little H_2SO_4

pg 155

a, e, f

Do now:

Write the products of the following reactions:

(Decide what functional group will be formed then write the product)

Butan-1-ol and ethanoic acid with a little conc. H_2SO_4

Ester

Butan-2-ol and $\text{H}^+/\text{Cr}_2\text{O}_7^{2-}$

Ketone

Propan-2-ol and conc H_2SO_4

Alkene

2-chlorobutane and aqueous NaOH

Alcohol

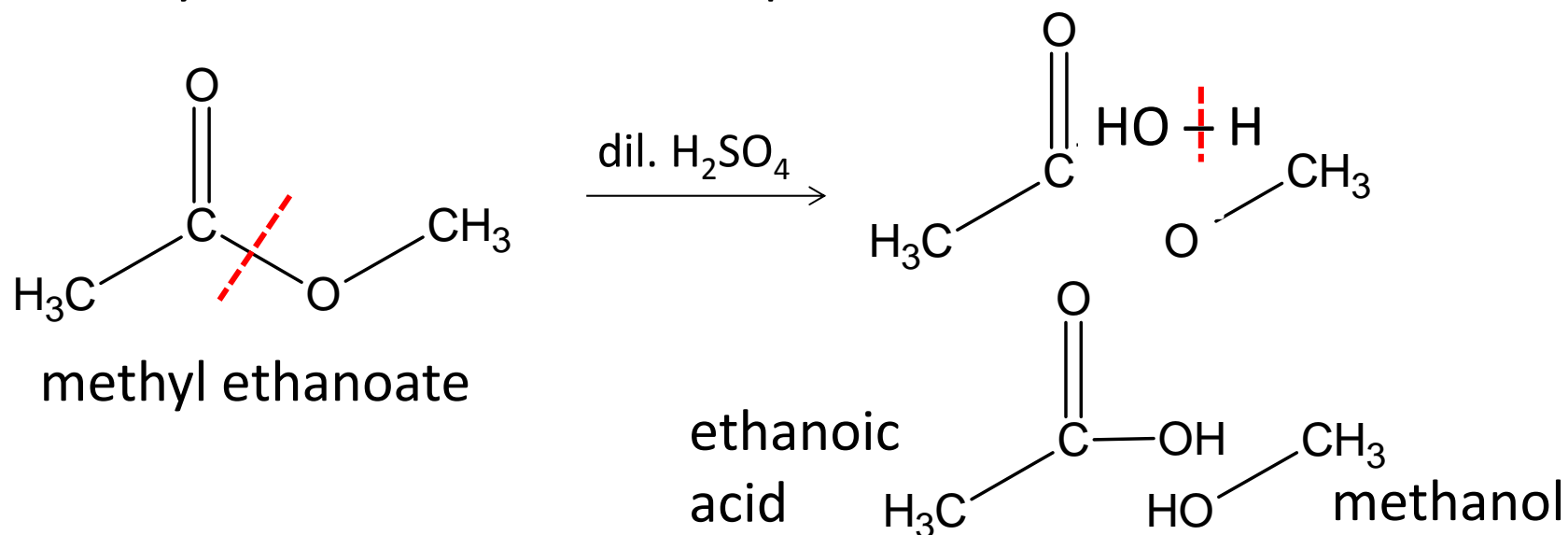
Reactions of esters

Hydrolysis

Esters can be hydrolysed (addition of water) under acidic or basic conditions.

Acidic conditions

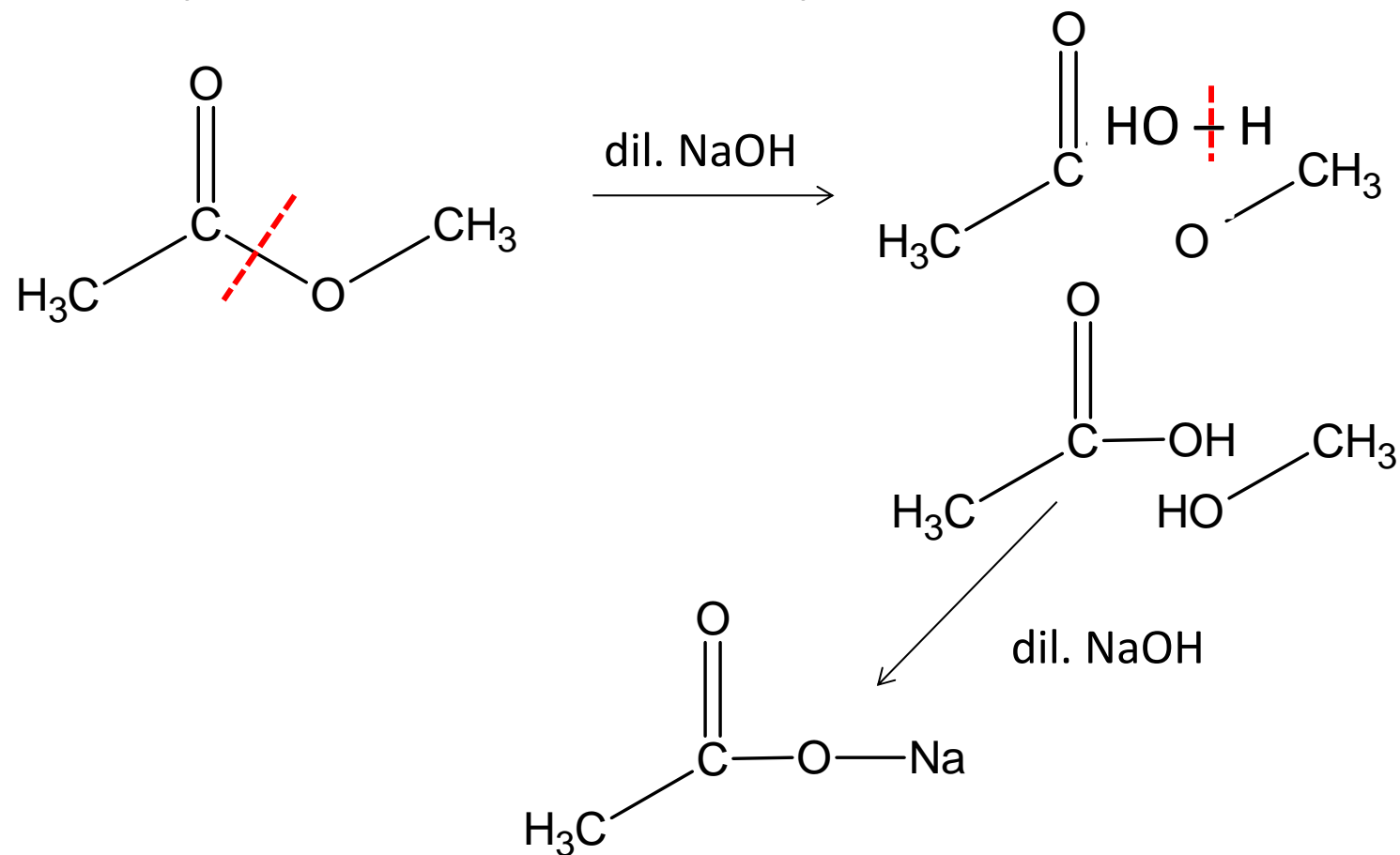
When hydrolysed under acidic conditions, using dil. H_2SO_4 , a carboxylic acid and alcohol are produced from the ester.



Reactions of esters

Basic conditions

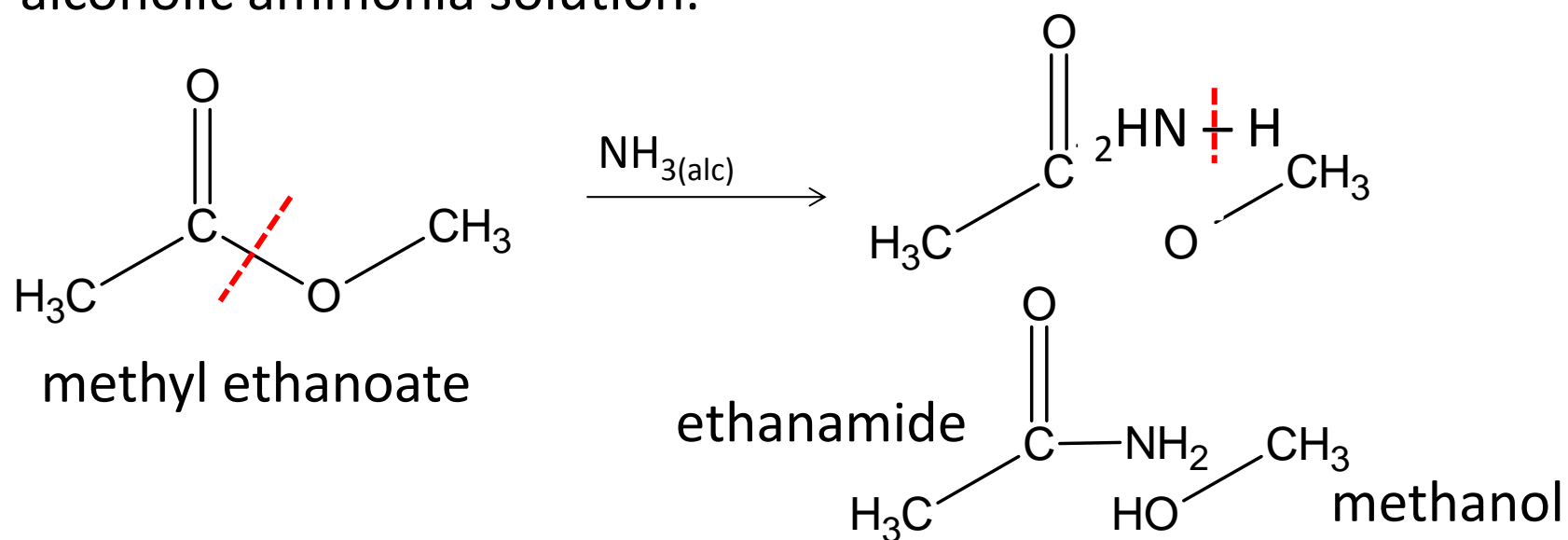
When hydrolysed under basic conditions, using dil. NaOH, a carboxylate salt and alcohol are produced from the ester.



Reactions of esters

Ammonolysis

Esters can form amides and alcohols from a reaction with alcoholic ammonia solution.



Reactions of esters

What would be the product of the following reactions?

Write equations for the following reactions using structural formula.

Butyl ethanoate is refluxed with hydrochloric acid

Ethyl ethanoate is heated with alcoholic ammonia solution

Propyl hexanoate is refluxed with dilute sodium hydroxide

Exam Questions

Typically about formation or hydrolysis

Exam 2014 Q1 c) (fats and oils)

Exam 2014 Q3 a)

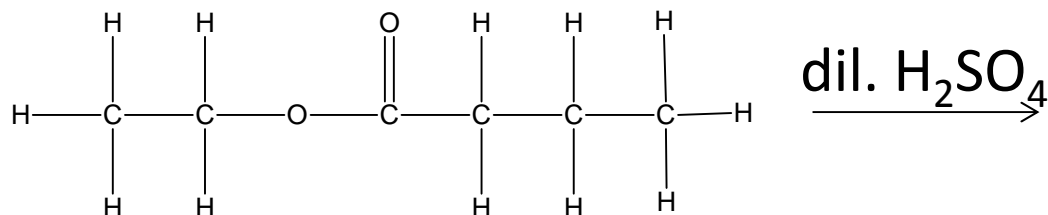
Exam 2013 Q1 d)

Esters were only included in this standard in 2013, previously they were included in the level 2 standard for organic chemistry.

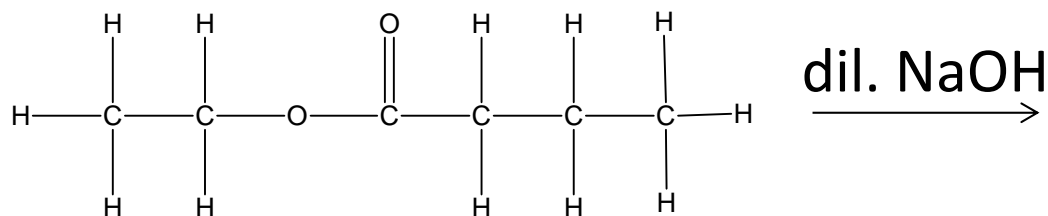
Do now:

Complete the following reactions for ethyl butanoate:

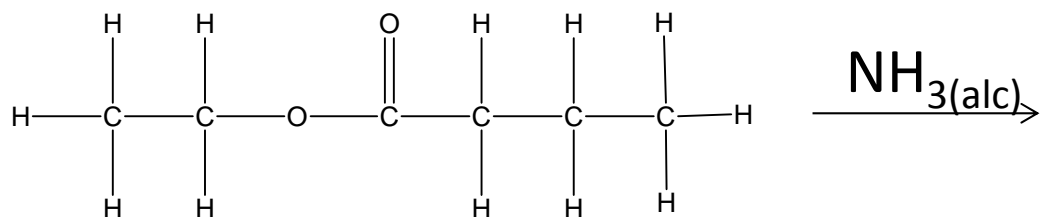
a) Acid hydrolysis



b) Base hydrolysis



c) Formation of amides



Ester preparation

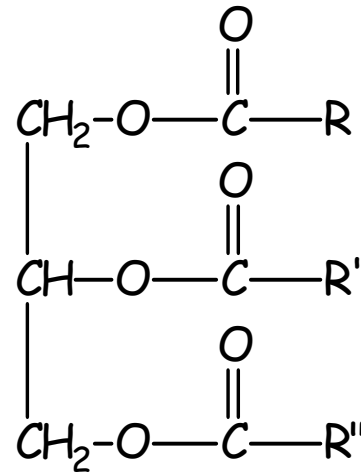
Prepare esters from these carboxylic acids and alcohols

Your results table should look like this.....

Alcohol	Carboxylic acid	Observation /smell	Name of ester
ethanol	ethanoic acid		
pentan-1-ol	ethanoic acid		
ethanol	butanoic acid		
ethanol	methanoic acid		
octan-1-ol	ethanoic acid		
methanol	salicylic acid		

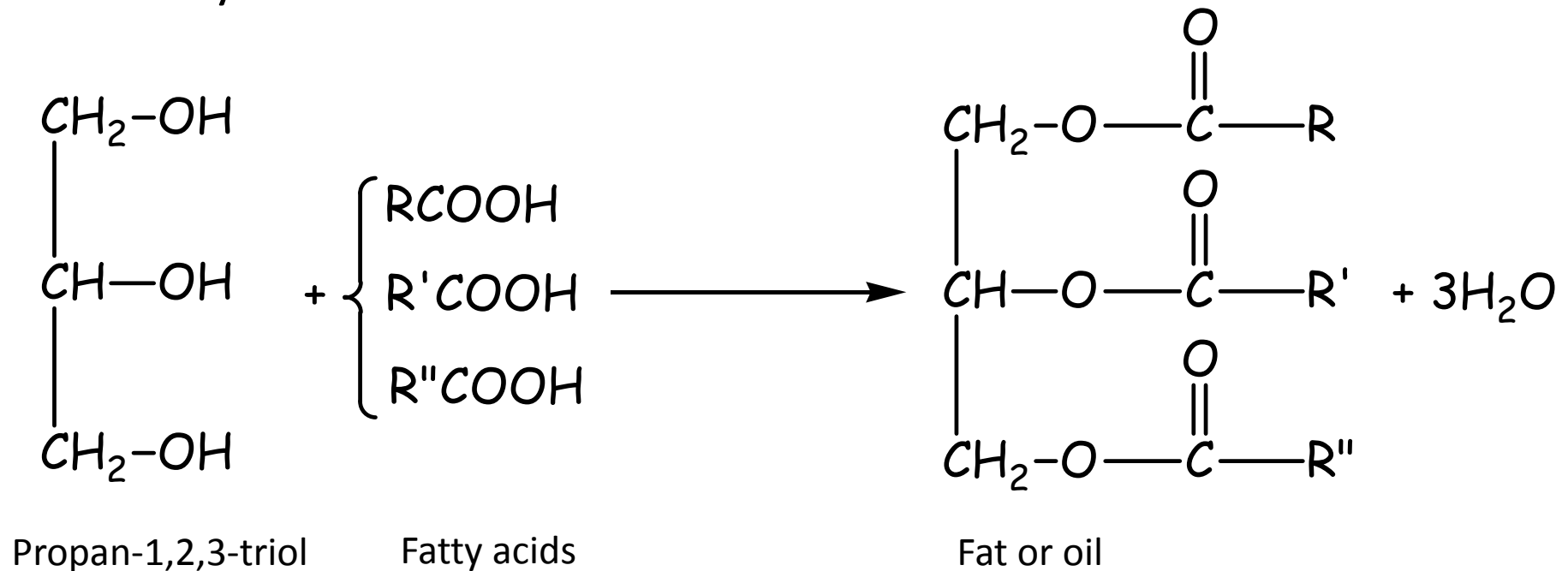
Fats and oils

Naturally occurring esters are found in animal and vegetable fats, (liquid fats are often referred to as oils).



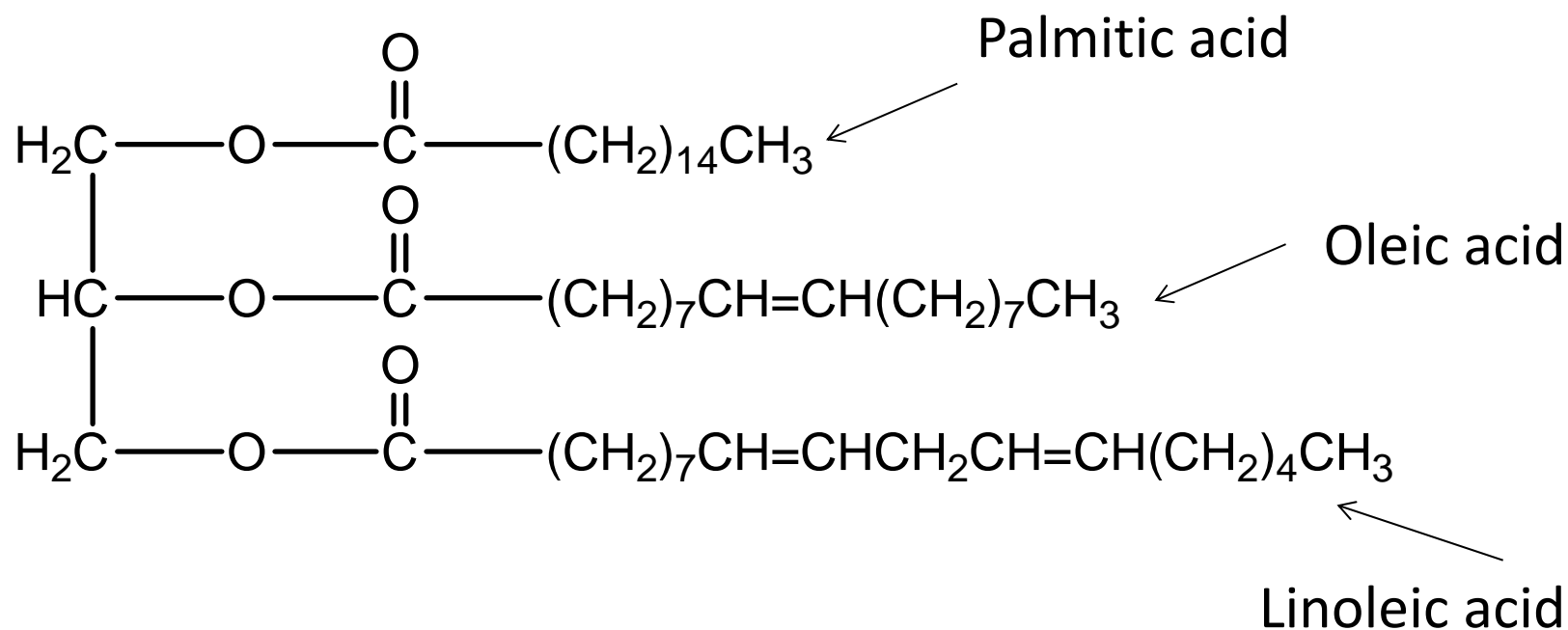
Fats and oils

Fats and oils are triesters of 1,2,3-propantriol and long chain carboxylic acids.



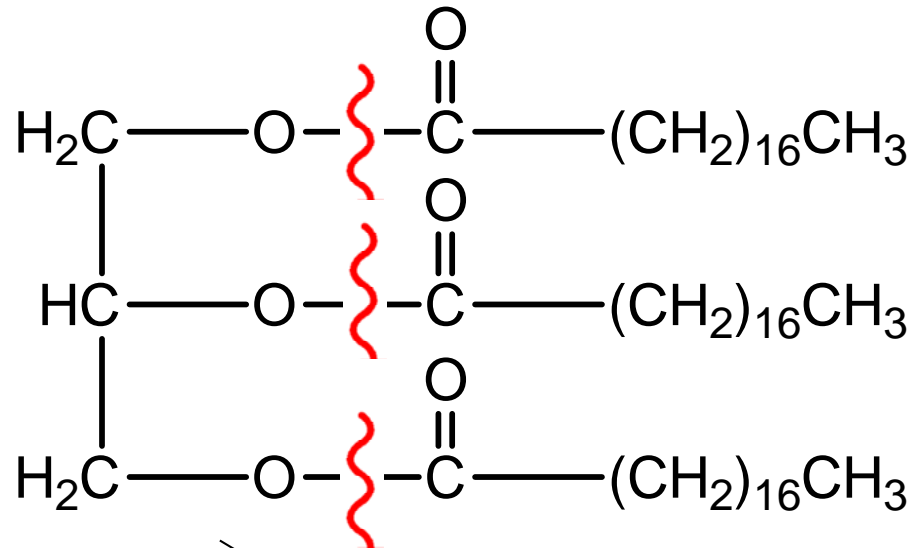
The common name for 1,2,3-propantriol is glycerol.
Fats and oils are sometimes called tri glycerides.

Fats and oils



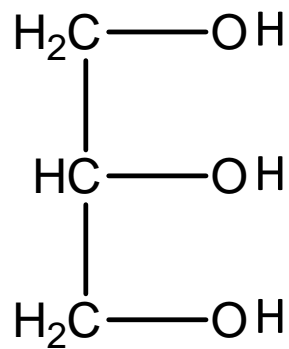
Fats and oils behave just as esters do, so they can be hydrolysed by acids or bases.

Fats and oils

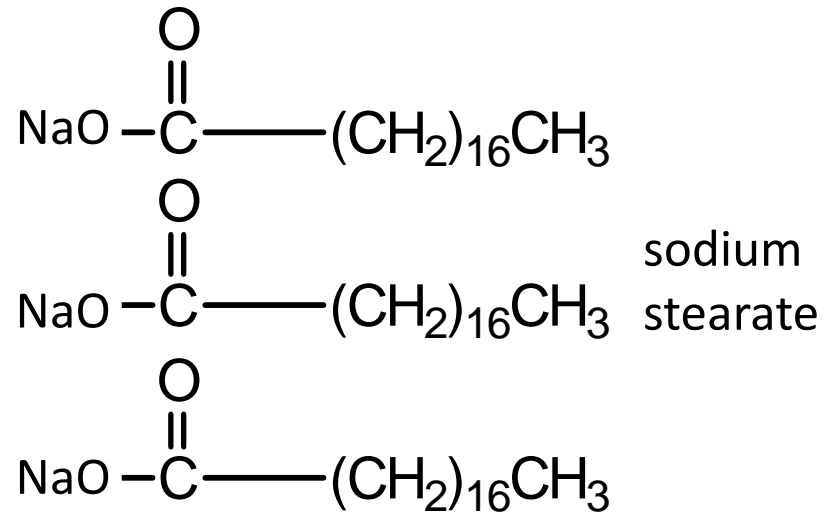


This fat is the major component of beef fat and is made from stearic acid.

dil. NaOH



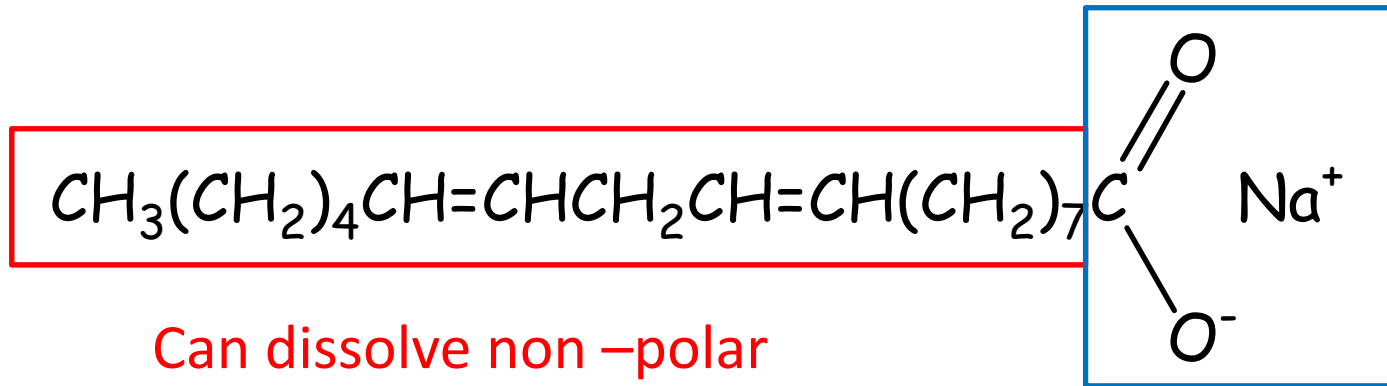
glycerol



Saponification

The hydrolysis of fats and oils by dilute sodium hydroxide gives glycerol and the sodium salt of fatty acids.

Sodium salts of fatty acids were the early versions of soaps, what properties do soaps have that might come from the sodium salt of a fatty acid?



Can dissolve non-polar substances like grease

Mixes with water