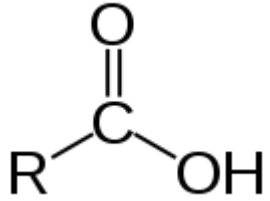
# Carboxylic Acids, Esters, and Fats

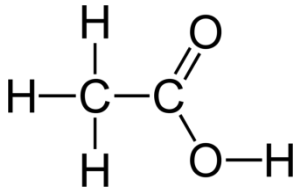
Chapter 1.6

# The Carboxyl Group

- A **carboxyl group** is a carbon atom that is double-bonded to one oxygen atom and single-bonded to a hydroxyl group



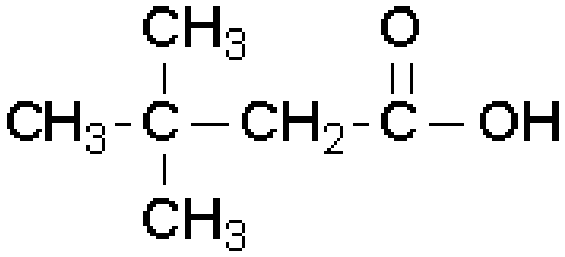

- A **carboxylic acid** is a weak organic acid containing at least one carboxyl group

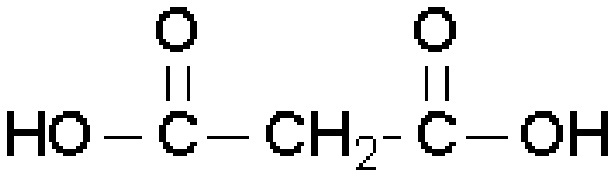



ethanoic acid

# Naming Carboxylic Acids

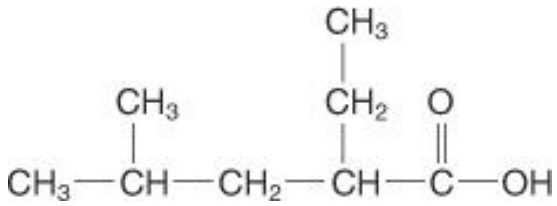
- Use the suffix *–oic acid*
- Number the parent chain so that the carboxyl group is on carbon one
- If an acid has two carboxyl groups use the suffix *-dicarboxylic acid*

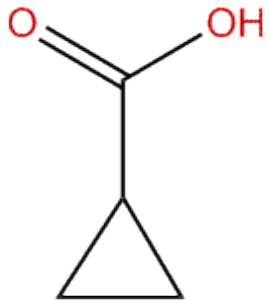




# Practice

1) Name the following carboxylic acids

a) 


b) 

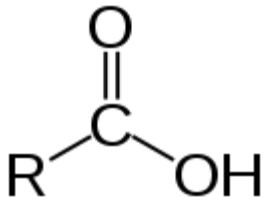

2) Draw Structural diagrams for the following carboxylic acids

a) methylpropanoic acid

b) 3-hydroxypentane dicarboxylic acid

# Properties of Carboxylic Acids

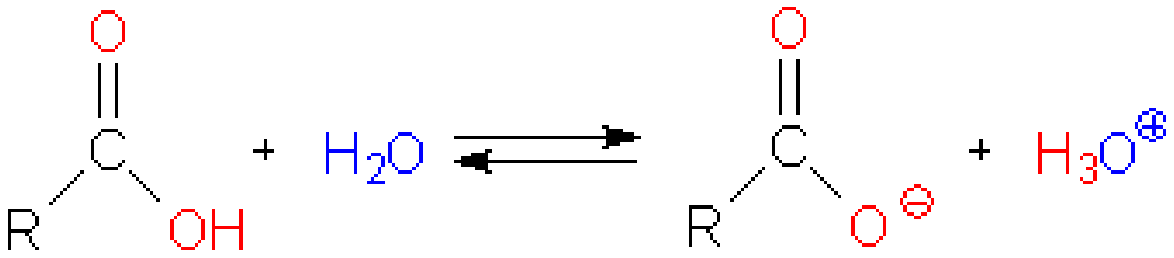
- The carboxyl group makes crboxylic acids polar and gives them the ability to hydrogen bond



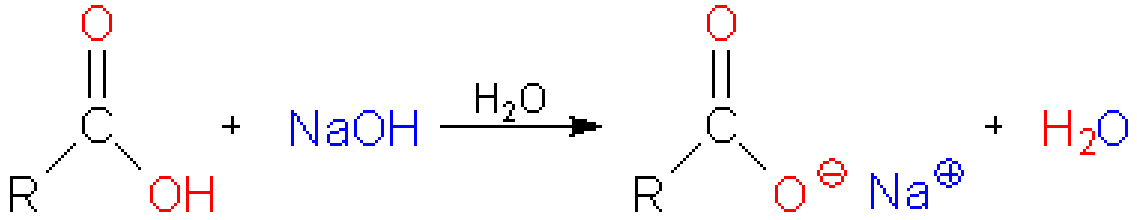

- Carboxylic acids have very high melting and boiling points
- Carboxylic acids are soluble in water

# Properties of Carboxylic Acids

- Carboxylic acids are weak acids

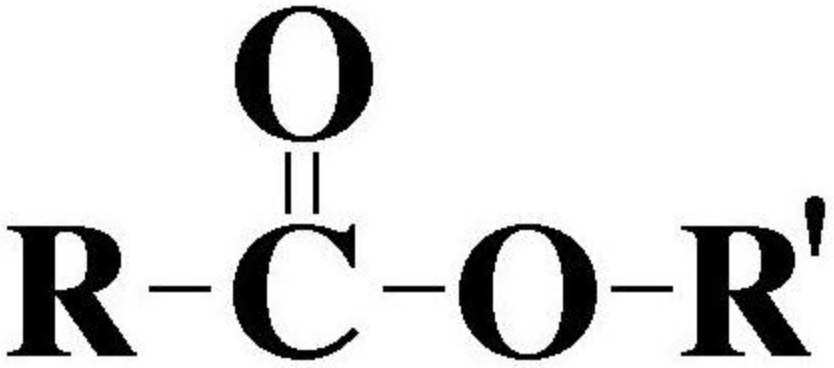



- They react with bases to form water and a salt



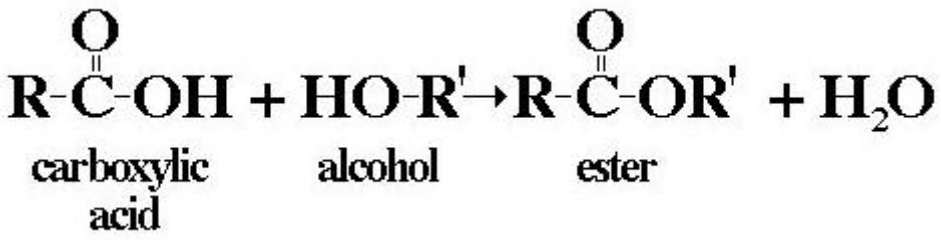
# Esters

- An **ester** is an organic compound that contains a carbonyl group bonded to a second oxygen atom which is bonded to another carbon atom



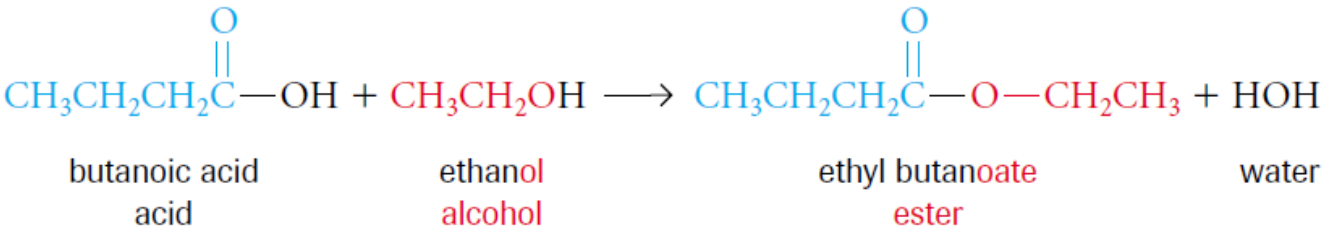
# From Carboxylic Acids and Alcohols to Esters

- Esters are formed by the condensation reaction of a carboxylic acid and an alcohol
- This reaction requires a catalyst and is sometimes called esterification



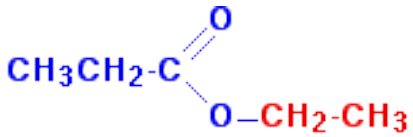
# Naming Esters

- Esters are named based on the alcohols and acids that they are made of
- The first part of the name comes from the alcohol and is named as an *alkyl-* branch
- The second part of the name comes from the carboxylic acid the -oic acid suffix is replaced with the suffix *-oate*

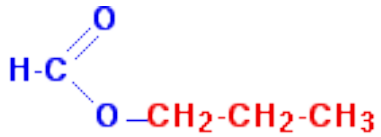


# Naming Esters

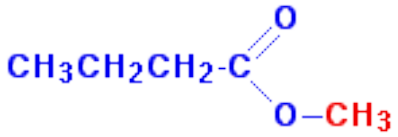
- Here are some examples:



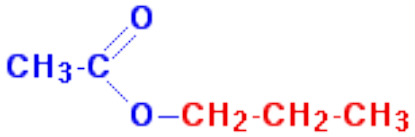

ethyl propanoate




propyl methanoate



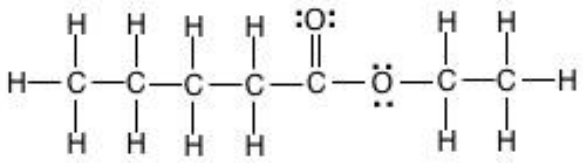

methyl butanoate

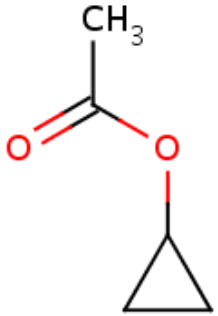



propyl ethanoate

# Practice

1) Name the following esters:

a) 

b) 


2) Draw structural diagrams for the following esters:

a) methyl benzoate

b) propyl heptanoate

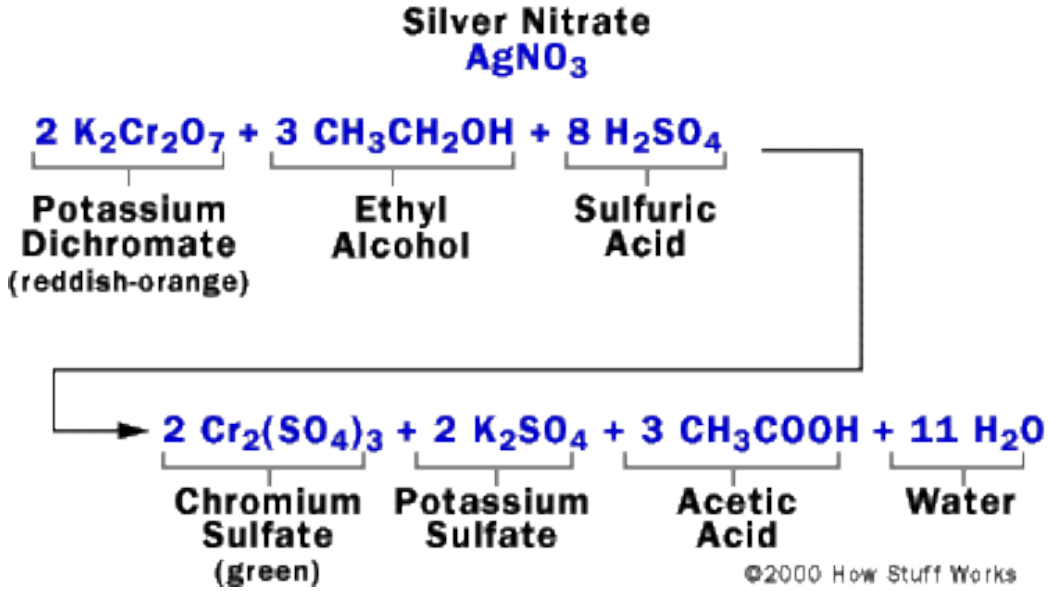
# Properties of Esters

- Esters often have fruity odours
- The carbon oxygen bond in esters is a polar bond which makes esters soluble and gives them the dipole-dipole force
- Since they do not have a hydroxyl group they cannot hydrogen bond and so are less soluble and have lower melting and boiling points than carboxylic acids

# Reactons Involving Carboxylic Acids and Esters

**Formation of Carboxylic Acids**

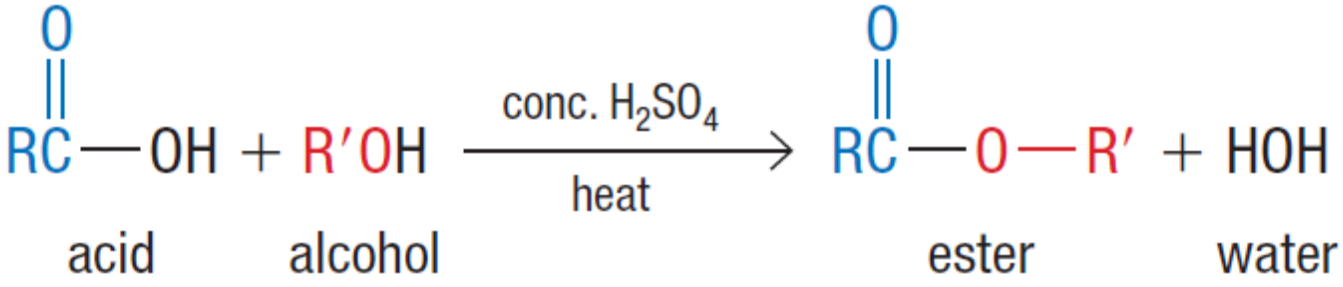
- Recall that primary alcohols undergo an oxidation reaction to form first aldehydes and then carboxylic acids
- This is how the roadside breathalyser test works



# Reactions Involving Carboxylic Acids and Esters

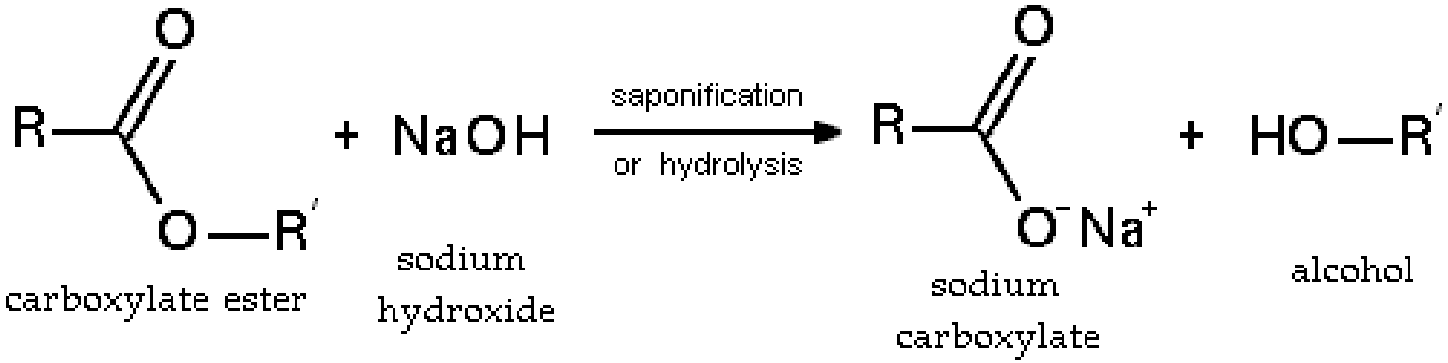
**Formation of Esters**

- **Esterification** is a condensation reaction in which an alcohol and a carboxylic acid react to form an ester and water



# Reactions Involving Carboxylic Acids and Esters

- **Hydrolysis** is the breaking of a covalent bond in a molecule by the addition of the elements of water (hydrogen and oxygen)
- This reaction is the reverse of esterification. It involves the splitting of an ester into carboxylic acid and alcohol components



# Fats and Oils

- Use page 53 and 54 of your textbook to prepare your own notes on the Fats and Oils section

# HOMEWOK

Required Reading:

p. 47-55

Questions:

p. 48 #1-2

p. 50 #1-2

p. 53 #1

p. 55 #1-10a