

### 1.7 Carboxylic Acids and Esters

- Carboxylic Acids are organic acids, which contain the carboxyl group.
- Carboxylic acids taste sour (acetic acid - *vinegar*)
- Carboxyl group  $\text{-COOH}$       General Formula  $\text{R-COOH}$
- Esters are the product of a carboxylic acid and an alcohol that forms a type of organic salt in a condensation reaction known as esterification.
- Esters generally smell pleasant.
- General Formula:  $\text{R-COO-R'}$

#### Naming Carboxylic Acids

- The parent alkane is the longest chain containing the carboxyl group (the carbon in the carboxyl group is also counted).
- The  $\text{-e}$  is dropped and  $\text{-oic acid}$  is added to the parent alkane.
- E.g. formic acid (methanoic acid) and acetic acid (ethanoic acid)

- E.g. aromatic acid: benzoic acid (phenylmethanoic acid)

- Multiple carboxyl groups use a prefix before  $\text{-oic acid}$
- E.g. propanedioic acid and oxalic acid (ethanedioic acid)

- What happens when the parent is an alkene? E.g. propenoic acid

#### Properties of Carboxylic Acids

- The carboxyl group is composed of a hydroxyl group and a carbonyl group. This makes it very polar and the presence of the  $\text{-OH}$  allows for hydrogen bonding to other acid molecules and to water.
- Very high melting point when compared to the parent alkane.
- Short chain acids are soluble in water.
- They are weak acids and react like other acids.

#### Preparing Carboxylic Acids

- Alcohols are oxidized to become aldehydes. Further oxidation turns aldehydes into acids.
- E.g.  $\text{ethanol} + \text{oxidizer} \rightarrow \text{ethanal} + \text{oxidizer} \rightarrow \text{ethanoic acid}$   
(remember that oxidation is the addition of oxygen or the removal of hydrogen)

- Read page 62 to see how a breathalyzer works.

### Naming Esters

- Formed from alcohols and carboxylic acids in an esterification.
- E.g. butanoic acid + ethanol → ethyl butanoate + water

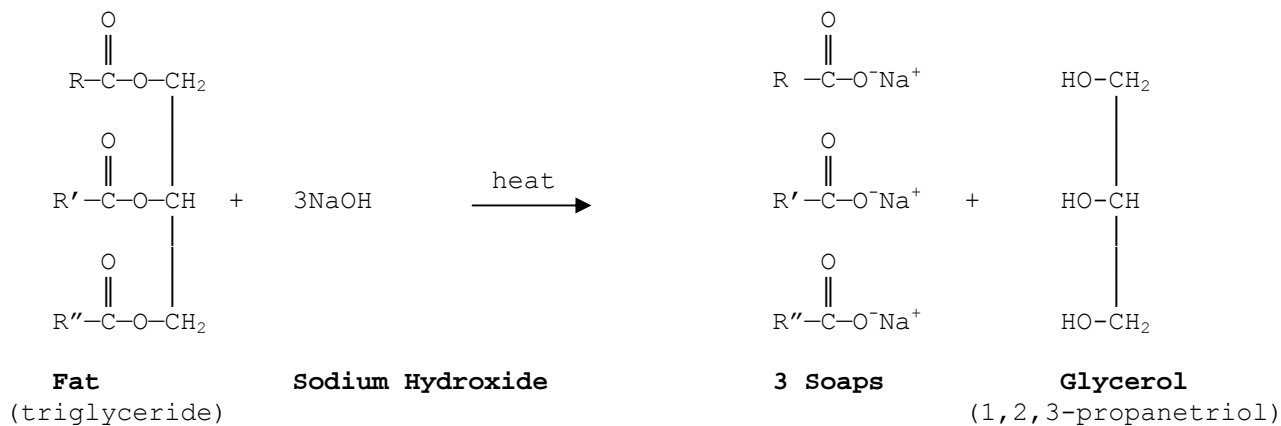
- The alcohol contributes the alkyl group. The acid contains the ester linkage and the –oic acid is dropped and –oate is added.

### Properties of Esters

- Since the –OH has been lost in an ester, the ester is no longer acidic and cannot form hydrogen bonds. They are less polar than the parent acid and have lower melting points.
- Short esters are volatile and are easily detected by scent and are used as artificial aromas and flavours.
- Long esters are waxy solids.

### Reactions of Esters (Hydrolysis)

- When an ester is treated with an acid or base the reversal of esterification occurs. It splits into a carboxylic acid and an alcohol.
- When an ester is treated with a strong base such as NaOH, a hydrolysis reaction occurs but a sodium salt of the acid is formed. This process is called saponification and is used to make soap.
- E.g. Saponification



### Homework

- Practice 1,2,3,4,5,7,11,12
- Questions 1,2,3,4