3055 BA SANGAM COLLEGE

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WORKSHEET 19

School: **Ba Sangam College** Subject: **Chemistry**

Year:**12** Name:_____

Strand	**4 Materials**
Sub strand	**4.2 Organic Chemistry**
Content Learning Outcome	CH 12.4.2.2 Investigate the preparations and reactions of alcohols and carboxylic acids.

Reactions of Carboxylic acids

1. Reaction with water

The carboxylic acids are acidic because of the hydrogen in the -COOH group.
If mixed with water, a hydrogen ion is transferred from the -COOH group to a water molecule.
For example, when ethanoic acid is mixed with water, an ethanoate ion is formed together with a hydronium ion.

$$CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$$

2. Reaction with base

These are simple neutralisation reactions and are just the same as any other reaction in which hydrogen ions from an acid react with hydroxide ions.
They are most quickly and easily represented by the equation:

$$H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$$

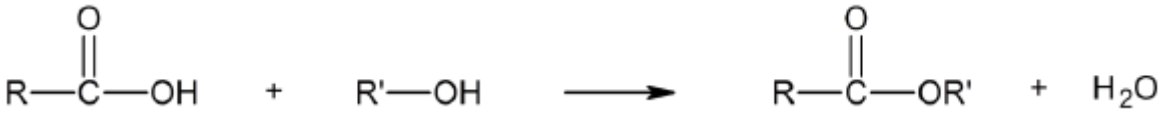
For example, if dilute ethanoic acid is mixed with sodium hydroxide solution, a colorless solution containing sodium ethanoate is formed.
This is an exothermic reaction thus temperature of the reaction mixture will increase.

3. Reaction with alcohol

The condensation reaction between an alcohol and a carboxylic acid produces the organic compound called **esters**.
Esters have characteristic smells and are insoluble in water.
Esterification is the process where an alcohol reacts with a carboxylic acid under acidic conditions and high temperature.
This process is known as refluxing. Sulfuric acid is added to the mixture while it is being refluxed since it acts as a catalyst to allow more ester to be formed during the reaction. It also removes the water formed and acts to create the acidic conditions necessary to produce the ester.
Sodium carbonate is added to the mixture to neutralize any unchanged acid. The ester formed is immiscible with water and can be separated by decantation.
The general equation for the production of esters from carboxylic acids and alcohol is:
Example: When ethanol is refluxed with ethanoic acid in the presence of sulphuric acid

catalyst, the ester **ethyl ethanoate** is formed.

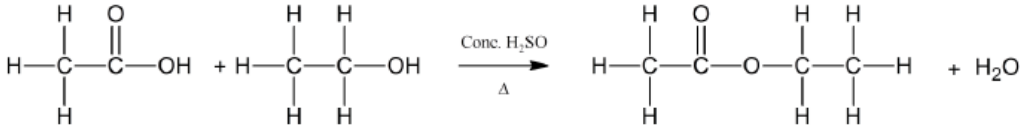
$$CH_3COOH_{(aq)} + NaOH_{(aq)} \rightarrow \underset{\text{Sodium ethanoate}}{CH_3COONa_{(aq)}} + H_2O_{(l)}$$



IUPAC Naming Esters

1. Change the name of the parent alcohol to end in –yl.
2. Change the name of the parent acid to end in –oate.
3. Combine the alcohol and the acid name (*The alcohol name is written first followed by the acid name).*

Example: When ethanol is refluxed with ethanoic acid in the presence of sulphuric acid catalyst, the ester **ethyl ethanoate** is formed.



Ethyl ethanoate

Activity

1. Draw the structure of the following carboxylic acids.

i. 2-methlypentanoic acid

ii. 3,3-dimethlybutanoic acid

iii. 2,2-dimethylpropanoic acid

(3m)

2. Ethanol is warmed (refluxed) with ethanoic acid to which a few drops of concentrated sulphuric acid has been added.

i. Write balanced equation for the reaction that occurs between ethanol and ethanoic acid.

_____

_____

_____(1m)

ii. What is the purpose of sulphuric acid?

_____

_____(1m)

iii. To what class of organic compound does the product belong to?

_____(1m)

iv. State one distinctive property of this product._____(1m)