### Equilibrium Constant – Equipment list

**Technician’s Guide**

**Esterification Route Procedure**

You will need:

A selection of 150 cm3 conical flasks or similar with stoppers to fit – one/group

Some parafilm

25 cm3 measuring cylinders – one/group – after the first week

Bottles of Thymol blue indicator – one/group - after the first week

A burette - one/group - (after one week when the mixture is to be titrated)

Each Group will also require access to:

A balance (accurate to 2 d.p.)

A bottle of glacial ethanoic acid

A bottle of methanol (not IMS)

A bottle of standardised hydrochloric acid solution (~1 mol l-1)

Three burettes. You can set up one containing the glacial ethanoic acid, the second containing the methanol and the third containing the hydrochloric acid. Ensure enough sets of 3 are set up to accommodate the number of groups participating and to minimise waiting times for dispensing solutions.

Filter funnels

Distilled water – after the first week

A bottle of standardised sodium hydroxide solution (~1 mol l-1) – after the first week.

# Note: Using HCl(aq) and NaOH (aq) of concentration ~ 1M, and taking ~3.7 cm3 of methanol (~3g), ~2.5 cm3 of glacial ethanoic (~3g) acid and 6.2 cm3 of the HCl, gives a titration in the order of ~31cm3 of ~1M NaOH(aq) required. These figures can be used to estimate the volumes of the ethanoic acid, methanol, HCl and NaOH required for all the groups to complete the experiment.

### Hydrolysis Route Procedure

You will need:

A selection of 150 cm3 conical flasks or similar with stoppers to fit – one/group

Some parafilm

25 cm3 measuring cylinders – one/group – after the first week

Bottles of Thymol blue indicator – one/group -– after the first week

A burette - one/group - (after one week when the mixture is to be titrated)

Each Group will also require access to:

A balance (accurate to 2 d.p.)

A bottle of methylethanoate

A bottle of standardised hydrochloric acid solution (~1 mol l-1)

Two burettes. You can set up one containing the methylethanoate and the second containing the hydrochloric acid. Ensure enough sets of 2 are set up to accommodate the number of groups participating and to minimise waiting times for dispensing solutions.

Filter funnels

Distilled water – after the first week

A bottle of standardised sodium hydroxide solution (~1 mol l-1) – after the first week.

Note: Using HCl(aq) and NaOH (aq) of concentration ~ 1M, and taking (~3.2cm3 ) of the ester (~3g) and 6.2 cm3 of the HCl, gives a titration in the order of ~33-35 cm3 of ~1M NaOH(aq) required. These figures can be used to estimate the volumes of the ester, HCl and NaOH required for all the groups to complete the experiment.

**SSERC Risk Assessment** (revised version November 2009)

(based on HSE ‘5 steps to risk assessment’)

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| Activity assessed | Determination of an Equilibrium Constant by experiment |
| *Date of assessment* | 8/19/2018 |
| *Date of review (****Step 5****)* |  |
| *School* |  |
| *Department* |  |

| Step 1 | Step 2 | Step 3 | Step 4 |
| --- | --- | --- | --- |
| *List Significant hazards here:* | *Who might be harmed and how?* | *What are you already doing?* | *What further action is needed?* | *Action by whom?* | *Action by when?* | *Done* |
| **Esterification** Methanol is toxic and highly flammableEthanoic acid is corrosive and flammable1M sodium hydroxide is corrosiveReaction mixture (containine methanol, ethanoic acid and methyl ethanoate) is flammable and toxic | Pupil / teacher / technician while preparing reaction tubesPupil / teacher / technician while preparing reaction tubesPupil while carrying out titration.Pupil while carrying out titration. | Avoid all sources of ignitionWork in well-ventilated area or fume cupboard.Use rubber or plastic gloves and eye protection goggles (BS EN 166 3).Wear nitrile or pvc gloves and eye protection, goggles (BS EN 166 3). Handle in a fume cupboard.Wear goggles (BS EN 166 3)Avoid all sources of ignitionWork in well-ventilated area or fume cupboard.Wear rubber or plastic gloves and goggles (BS EN 166 3) |  |  |  |  |
| **Hydrolysis**Methyl ethanoate is flammable and harmful to skin and by inhalation1M sodium hydroxide is corrosiveReaction mixture (containine methanol, ethanoic acid and methyl ethanoate) is flammable and toxic | Pupil / teacher / technician while preparing reaction tubesPupil while carrying out titration.Pupil while carrying out titration. | Avoid all sources of ignitionWork in well-ventilated area or fume cupboard.Wear nitrile or pvc gloves and eye protection, goggles (BS EN 166 3).Wear goggles (BS EN 166 3)Avoid all sources of ignitionWork in well-ventilated area or fume cupboard.Wear rubber or plastic gloves and goggles (BS EN 166 3) |  |  |  |  |

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| **Description of activity:**1. Methanol and ethanoic acid (glacial) are mixed and 1M HCl is added. The flasks are stoppered and left for a week with daily shaking.

The reaction mixture is titrated against 1M NaOH using thymol blue indicator1. Methyl ethanoate is mixed with 1M HCl. The flasks are stoppered and left for a week with daily shaking.

The reaction mixture is titrated against 1M NaOH using thymol blue indicator |

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| **Additional comments:** |