

# Chemistry

# CHM6T/P14/task

## Unit 6T A2 Investigative Skills Assignment

### Task Sheet

#### The determination of an equilibrium constant

Some esters are sweet-smelling organic compounds that have a range of uses as pleasant flavours and odours.

In this task, you will investigate the reaction in which ethanoic acid and propan-1-ol form a pleasant-smelling liquid ester. The reaction is slow and sufficient time must be allowed for this mixture to establish an equilibrium. You will then carry out an experiment to determine the equilibrium constant,  $K_c$ , for the reaction.

The task is in two parts.

**Part 1** Known amounts of ethanoic acid and of propan-1-ol are mixed with sulfuric acid and left for at least 1 week to reach equilibrium.

**Part 2** This equilibrium mixture is added to a large volume of water that effectively stops the reversible reaction. Samples of this diluted equilibrium mixture are then titrated with sodium hydroxide solution in order to determine the amount of acid in this mixture.

#### Procedure

- **Wear eye protection at all times.**
- **Assume that all substances are toxic, flammable and irritant.**

#### Part 1 Preparing the equilibrium mixture

- 1 Label a boiling tube with your name.
- 2 Use the burettes supplied to prepare a mixture in this boiling tube by adding  $6.0 \text{ cm}^3$  of ethanoic acid,  $6.0 \text{ cm}^3$  of propan-1-ol, followed by  $2.0 \text{ cm}^3$  of dilute sulfuric acid. It is important that these volumes are measured as accurately as possible.
- 3 Seal the boiling tube tightly with cling film. Swirl the mixture so that the contents are thoroughly mixed. Leave this mixture for at least 1 week to reach equilibrium. You will use this mixture in Part 2 of the task.

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## Part 2 Titrating the equilibrium mixture

- 1 Rinse a clean 250 cm<sup>3</sup> volumetric (graduated) flask with distilled or deionised water. Use a funnel to transfer all the contents of the boiling tube you prepared in Part 1 into the flask. Rinse the boiling tube with distilled or deionised water twice and add these washings to the volumetric flask.
- 2 Use distilled or deionised water to make up the solution in the volumetric flask to 250 cm<sup>3</sup>. Stopper the flask, then invert and shake the contents **thoroughly**. You may see two layers in the flask. In this case, continue inverting and shaking the flask until the two layers are thoroughly mixed.
- 3 Use a pipette filler to rinse a pipette with the diluted equilibrium mixture from the volumetric flask. You may find it helpful to pour some of the diluted equilibrium mixture into a beaker first. Use the pipette to transfer 25.0 cm<sup>3</sup> of the diluted equilibrium mixture to a 250 cm<sup>3</sup> conical flask.
- 4 Add 3 or 4 drops of phenolphthalein indicator to the conical flask.
- 5 Rinse a burette with the sodium hydroxide solution provided. Set up the burette and use a clean funnel to fill it with the 0.200 mol dm<sup>-3</sup> sodium hydroxide solution. Record the initial burette reading in a table of your own design on the Candidate Results Sheet.
- 6 Add the sodium hydroxide solution from the burette until the whole of the mixture in the conical flask first turns pink. The pink colour may fade after a short time. You should ignore this. Record this burette reading in your table.
- 7 Dispose of the contents of your conical flask as instructed by your teacher.
- 8 Rinse the conical flask with distilled or deionised water. Repeat the titration until you obtain a minimum of **two** concordant titres. You should do no more than five titrations.  
  
**Have one of your final burette readings checked by your teacher.**
- 9 Calculate and record the average titre on the Candidate Results Sheet. Show clearly the titres you used to calculate this average titre.

You are **not** required to carry out any further calculations on the Candidate Results Sheet. You will use your results in **Section A** of the Written Test.

**ISA CHM6T/P14 Candidate Results Sheet**Centre Number 

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Teacher Group .....

Candidate Name ..... Candidate Number 

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**Results**

Record your titration results in an appropriate table in this space.

**[8 marks]**Average titre / cm<sup>3</sup> .....

For Teacher's use only					
B		R		P	
C		A			

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