WJEC (Eduqas) Chemistry A-level

SP C3.4 - Preparation of an Ester and Separation by Distillation

Flashcards

Name the type of reaction which takes place between ethanol and ethanoic acid

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Ethanol and ethanoic acid react together in a condensation reaction.

It is also an esterification reaction since an ester is produced.

What is a condensation reaction?

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A condensation reaction is a reaction in which two molecules combine to form one molecule, usually with the loss of a small molecule (e.g. water).

Give the chemical equation for the reaction between ethanoic acid and ethanol

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$CH_3COOH + CH_3CH_2OH \rightarrow CH_3COOCH_2CH_3 + H_2O$

Ethanoic acid + ethanol → ethyl ethanoate + water

What apparatus is required to prepare a pure sample of ethyl ethanoate from ethanoic acid and ethanol?

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- Round bottom flask
- Beaker
- Conical flask
- 10 cm^3 measuring cylinder
- 25 cm^3 measuring cylinder
- Reflux condenser
- Thermometer
- Anti-bumping granules
- Warm water bath
- Clamp stand

Outline an experimental procedure to obtain a pure sample of ethyl ethanoate from ethanoic acid and ethanol

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1. Measure 25 cm^3 of ethanoic acid into a round bottomed flask.
2. Add 10 cm^3 of ethanol and a few anti-bumping granules to the flask.
3. Add 10 drops of concentrated sulfuric acid.
4. Swirl the flask gently to mix the reagents.
5. Warm the reaction mixture gently with the warm water bath for 15 minutes.
6. Distil off the ethyl ethanoate product.
7. Record the temperature at which the ester product is collected.

Why is a round bottom flask used in this experiment?

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The round bottom flask allows the reaction mixture to be evenly heated. The round bottom also allows for the mixture to be easily swirled without spilling.

What is the purpose of concentrated sulfuric acid in the reaction between ethanoic acid and ethanol?

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The concentrated sulfuric acid is a catalyst. It increases the rate of reaction by providing an alternative reaction pathway with a lower activation energy.

Why is the round bottom flask swirled before heating?

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Swirling the round bottom flask ensures all the reactant particles and catalyst particles are evenly distributed throughout the mixture. This will lead to more successful reaction collisions, leading to an increase in the rate of reaction.

What property allows the ester to be distilled from the reaction mixture?

What property allows the ester to be distilled from the reaction mixture?

Ethyl ethanoate has a lower boiling point compared water (the other product of the reaction). This means the ester will evaporate first when heated.

When heating the reaction mixture, before distillation, why is it important to control the temperature?

When heating the reaction mixture, before distillation, why is it important to control the temperature?

At this stage in the experiment you do not want any of the reactants/products to vaporise. The temperature must be controlled so that it is kept below the various boiling points.

Why is it important to carefully control the temperature during distillation?

Why is it important to carefully control the temperature during distillation?

The temperature must be carefully controlled and not be allowed to go higher than necessary to ensure only the ester will vaporise.

What is the purpose of anti-bumping granules?

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Anti bumping granules prevent the sudden production of large gas bubbles which can lead to 'bumping'. They encourage ‘smooth boiling’, preventing the liquid from splashing into the condenser.

Why is the round bottom flask heated in a water bath rather than being heated directly with a bunsen burner?

Why is the round bottom flask heated in a water bath rather than being heated directly with a bunsen burner?

Organic compounds, like ethanol and ethyl ethanoate, are flammable. Therefore, the water bath reduces the risk of the chemicals catching fire as it avoids the use of a naked flame.

Why might the distilled sample of ethyl ethanoate have impurities?

Why might the distilled sample of ethyl ethanoate have impurities?

The reaction may have not been complete. This means there may have been some ethanol left which was also vaporised and collected during distillation.

Some of the water particles may also contaminate the sample of ethyl ethanoate. Some of the surface water particles may gain enough energy to evaporate, causing them to be collected in the distillate.

How can the product be easily identified as an ester?

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Esters generally have distinct sweet smells which means if the product is sweet smelling, it can be identified as the ester.