

WJEC (Wales) Chemistry

A-level

SP 2.6 - Nucleophilic Substitution Reaction

Flashcards

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Give the chemical equation for the nucleophilic substitution reaction between 1-bromobutane and sodium hydroxide



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Give the IUPAC name of the organic product from the reaction between 1-bromobutane and sodium hydroxide



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Butan-1-ol



What is a nucleophile?



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A nucleophile is an electron pair donor.



What acts as the nucleophile in the reaction between 1-bromobutane and sodium hydroxide?



What acts as the nucleophile in the reaction between 1-bromobutane and sodium hydroxide?

The nucleophile is the hydroxide ion.

Sodium hydroxide provides the nucleophile.



What apparatus is required to carry out a nucleophilic substitution reaction between 1-bromobutane and sodium hydroxide?



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- Round bottom flask
- Beaker
- Conical flask
- Measuring cylinder
- Reflux condenser
- Thermometer
- Anti-bumping granules
- Bunsen burner with water bath
- Clamp stand



Outline an experimental procedure to prepare a pure sample of butan-1-ol from 1-bromobutane and sodium hydroxide



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1. Measure 25 cm^3 of $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$ into a round bottom flask. Add 25 cm^3 of 0.1 mol dm^{-3} NaOH solution and a few anti-bumping granules to the flask. This should be done in the fume cupboard.
2. Swirl the flask to mix the reagents, and set up the reflux condenser apparatus.
3. Turn on the water to run through the condenser.
4. Heat the water bath to allow the solution to be heated to reflux for 15 minutes.
5. Distil off the $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$. Collect it in a conical flask.
6. Record the temperature at which the liquid product is collected.



Why is a round bottom flask used in this experiment?



Why is a round bottom flask used in this experiment?

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.



How could you test that the product produced is butan-1-ol?



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Butan-1-ol is a primary alcohol. It can therefore be identified by reacting it with acidified potassium dichromate(VI). The orange solution will turn green if a primary or secondary alcohol is present.



What property allows butan-1-ol to be distilled from the reaction mixture?



What property allows butan-1-ol to be distilled from the reaction mixture?

Butan-1-ol has a relatively low boiling point (compared to the other product NaBr) which means it will evaporate first when heated.



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 product with the lowest boiling point will vaporise.



What is the purpose of anti-bumping granules?



What is the purpose of anti-bumping granules?

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 1-bromobutane and butan-1-ol, are generally flammable. Therefore, the water bath reduces the risk of the chemicals catching fire as it avoids the use of a naked flame.



Describe the process of reflux



Describe the process of reflux

Heating under reflux means that any vaporised compounds rise into the condenser, where they will then cool and return to the reaction mixture. This allows the temperature of the mixture to be increased without losing volatile reactants and products.



Why might the distilled sample of butan-1-ol have impurities?



Why might the distilled sample of butan-1-ol have impurities?

The reaction may have not been complete. This means there may have been some 1-bromobutane reactant left which was also vaporised and collected during distillation. This may occur since 1-bromobutane has a lower boiling point than butan-1-ol.



Why must the 1-bromobutane be added to the round bottom flask from within a fume cupboard?



Why must the 1-bromobutane be added to the round bottom flask from within a fume cupboard?

1-bromobutane is highly flammable.

