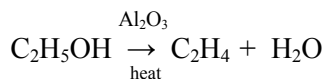


Preparation and properties of ethene

Theory

Ethanol is dehydrated using hot aluminium oxide as a catalyst to produce ethene.

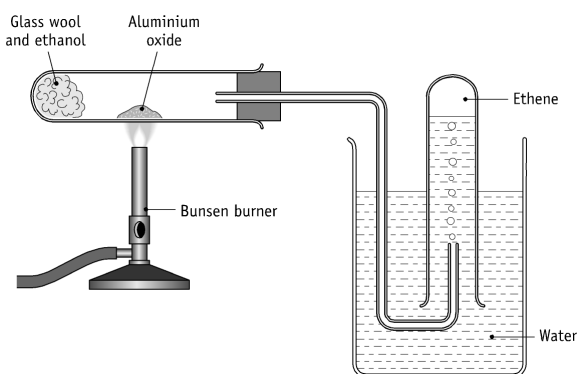


The ethene gas formed in the reaction is insoluble in water, and is therefore collected by downward displacement of water.

Procedure

Preparation

Pour ethanol into the reaction boiling tube to a depth of about 2 cm. Push in enough glass wool to soak up all of the ethanol. Set up the apparatus as shown in diagram, with about 2 g of aluminium oxide halfway along the boiling tube.



Heat the catalyst strongly, and occasionally heat the ethanol gently to drive the vapour over the catalyst. Collect a few test tubes of ethene by displacement of water, stoppering the test tubes when they are filled. The first test tube filled can be discarded, as it contains a mixture of air and ethene. When gas bubbles are no longer emerging from the delivery tube, remove the tube from the water, and then turn off the Bunsen burner.

Investigation of Properties

1. Ignite the gas in one of the test tubes. Describe the flame (coloured or clear, smoky or clean). Pour a few drops of limewater into the test tube. Stopper, shake well and record what you see.
2. Add a few drops of diluted bromine water to the second test tube of gas. Stopper and shake well. Record what you see.
3. Add a few drops of acidified potassium manganate(VII) solution to a third test tube of the gas. Stopper immediately and shake well. Record what you see.

student questions

Why is it desirable to push the glass wool into the tube after the ethanol has been added?

To ensure that all of the ethanol is soaked up.

Why should the ethanol not be heated strongly?

Strong heating of the ethanol will cause it to evaporate too quickly and escape from the tube before it can be dehydrated.

Would you expect all the test tubes of gas collected to contain equally pure samples of ethene? Explain your answer.

The first test tubes of gas collected will contain air and ethanol vapour as well as ethene. Subsequent test tubes of gas collected will contain ethene only.

Why is it very important to remove the delivery tube from the water as the Bunsen burner is turned off?

To avoid cold water being sucked back from the trough onto the hot glass of the reaction tube.

In each of steps 1,2 and 3 in the investigation of properties, give a reason for the results observed.

Step 1: The limewater is turned milky by the carbon dioxide formed by the combustion of ethene.

Steps 2 and 3: The decolourisations indicate unsaturation.

Industrial Uses

Alkenes are the raw materials for addition polymerisation. Ethene itself is used to make polythene, and substituted ethenes are used to make a range of other plastics. Ethene may also be used for the manufacture of ethanol.