Identifying alkenes, alcohols and halogenoalkanes Transcript

A functional group is an atom, or group of atoms, within an organic compound that determine the characteristic reactions of a homologous series. Some familiar examples include **alkanes**, **alkenes**, **alcohols**, **aldehydes**, **ketones**, **esters** and **amines**.

Unknown organic compounds can be identified using qualitative tests. Here, the tests for identifying alkenes, alcohols and halogenoalkanes are described.

To test for the presence of a double (or triple) bond within a substance, bromine water is used. This is known as the test for unsaturation.

Two test-tubes should be labelled, 1 and 2.

In test-tube 1, cyclohexene is added. In test-tube 2, cyclohexane is added.

Then, bromine water is added to each test-tube.

At first, nothing appears to happen in test-tube one containing cyclohexene.

As the reaction can only happen at the boundary between the two phases, the mixture is shaken.

Fairly quickly, the bromine decolourises, confirming unsaturation.

In this case, one double bond is present in the molecule.

The colourless addition product, 1,2-dibromocyclohexane is formed.

Test-tube 2, containing cyclohexane, is also shaken.

After shaking, the yellow-brown colour in the aqueous phase transfers to the organic phase because bromine is more soluble in the organic phase. However, it is not decolourised confirming that there are no double or triple bonds present in the molecule.

To test for different alcohols, acidified potassium dichromate(VI) is used. The alcohols react differently depending on whether they are primary, secondary or tertiary alcohols.

For this test, the three test-tubes should be labelled ‘primary’, ‘secondary’ and ‘tertiary’.

The primary alcohol used is propan-1-ol. The secondary alcohol used is propan-2-ol and the tertiary alcohol used is 2-methylpropan-2-ol.

Acidified potassium dichromate(VI) solution is then added to each test-tube.

After a few minutes, the test-tubes containing the primary and secondary alcohols have turned green-blue. The test-tube containing the tertiary alcohol is unchanged.

Primary and secondary alcohols undergo oxidation because they have at least one hydrogen atom on C-1.

Tertiary alcohols cannot be oxidised. This is because they do not contain a hydrogen atom on C-1, so cannot reduce the potassium dichromate(VI) solution.

The iodoform test can be used to identify the presence of a methyl alcohol group in alcohols.

If this group is present, the precipitate triiodomethane is produced.

First, ethanol is added to test-tube 1 and methanol is added to test-tube 2.

Then, iodine solution is added to each test-tube, and finally, sodium hydroxide solution is added to each tube.

The mixtures are shaken gently.

In test-tube 1, a pale yellow precipitate forms. In test-tube 2, no precipitate forms.

Ethanol contains a methyl alcohol group giving a positive result. Methanol does not have a methyl alcohol group and gives a negative result.

To test for a halogenoalkanes, the first step is to perform a substitution reaction, which releases the halide ion.

The halide ion is then tested with silver nitrate to confirm the presence of either chloride, bromide or iodide.

First, silver nitrate solution is added to three clean test-tubes. Then 1-iodobutane is added to test-tube 1, 1-bromobutane is added to test-tube 2, and 1-chlorobutane is added to test-tube 3.

The test-tubes are then placed in a water bath set at 50 °C.

The contents of each test-tube should begin to change.

In a relatively short period of time, the precipitates observed in each test-tube indicate the presence of a halogen atom.

In these experiments, the qualitative tests for identifying **alkenes**, **alcohols** and **halogenoalkanes** have been described.