AQA Chemistry A-level

3.3.6: Organic Analysis

Detailed Notes

3.3.6.1 - Tests for Functional Groups

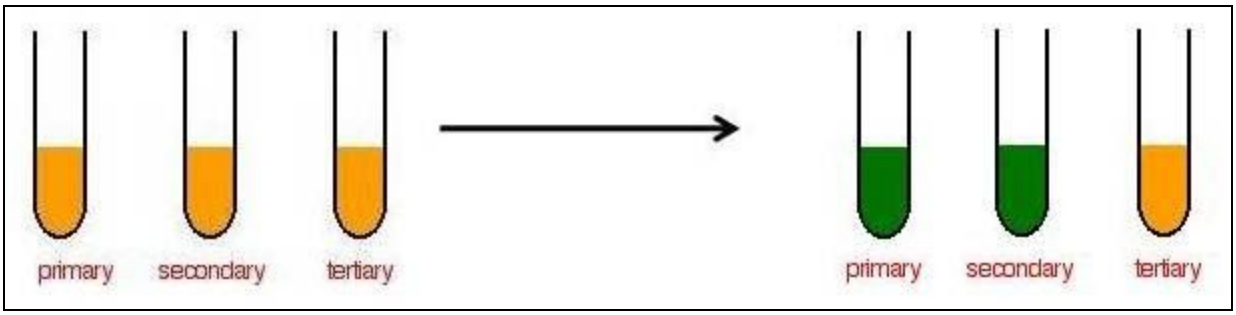
Alcohols

1° and 2° alcohols are identified using **acidified potassium dichromate**. It turns from **orange to green** if they are present.

3° alcohols are not oxidised and the potassium dichromate **remains orange**.

Example:

Image courtesy of chemhume.co.uk

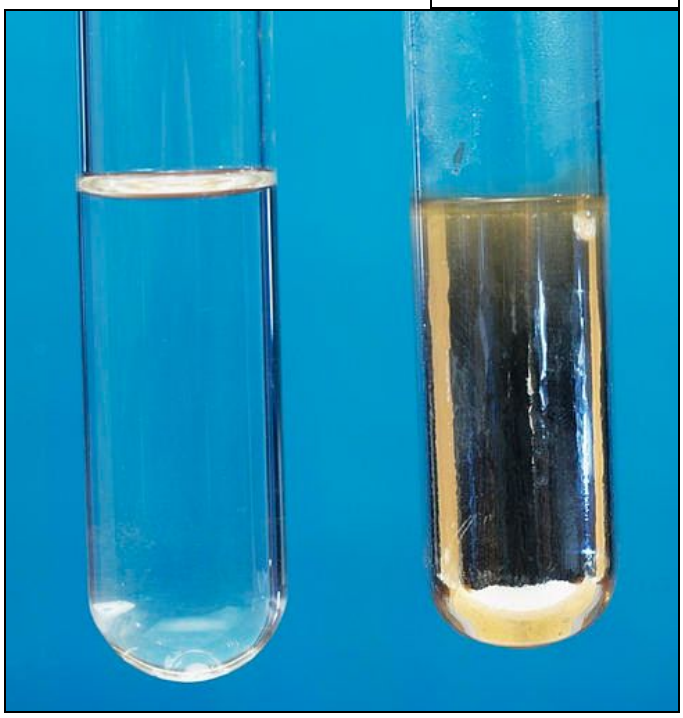


Aldehydes

Tollen's reagent can be used to identify aldehydes. It is added to the solution being tested and warmed gently. If an aldehyde is present, a **silver mirror will form** in the test tube. If not, the solution will **remain colourless**.

Example:

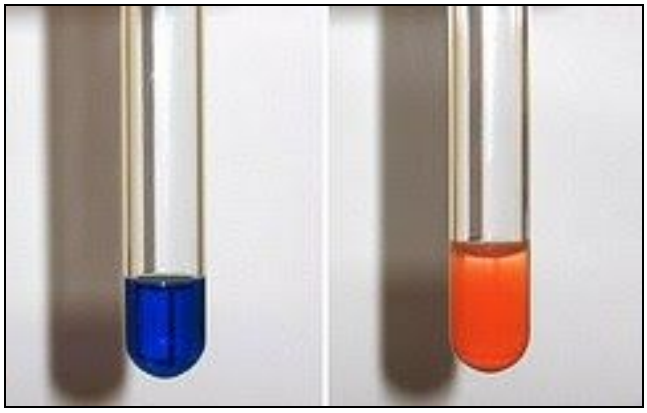
Image courtesy of fineartamerica.com



Fehling's solution is another way of testing for aldehydes. It is added to the solution being tested and heated. A **brick red precipitate** will form if an aldehyde is present and if not, the solution **remains blue** and there is no observed change.

Example:

Image courtesy of the university of oregon



Alkenes

Bromine water is used to test for **unsaturated hydrocarbons**. It changes from **orange-brown to colourless** if a carbon-carbon double bond is present. If not, no change is observed.

Example:

Image courtesy of pixels.com

Carboxylic Acid
These compounds react with **sodium carbonate** as acids, producing **CO_2**. This gas can be collected and tested using **limewater**. This solution will turn **cloudy** if the gas is CO_2.

Example:

3.3.6.2 - Mass Spectrometry

This analytical technique is used to identify compounds and determine their molecular formula (see 3.1.1).

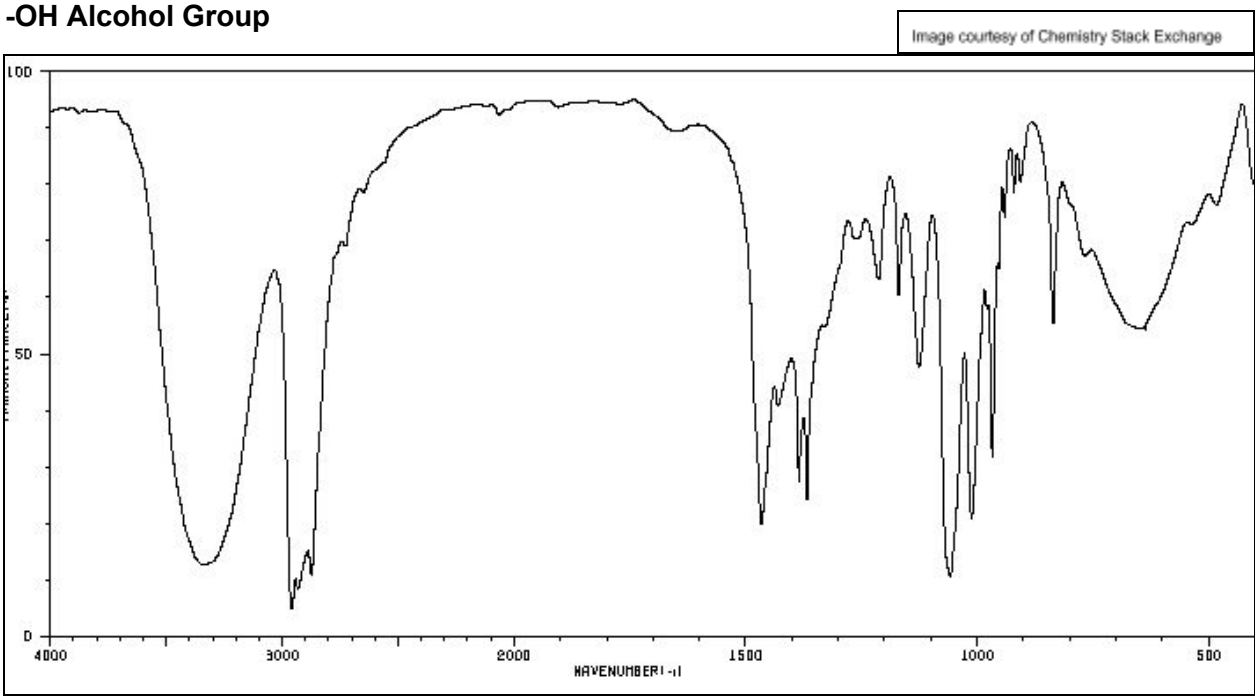
High Resolution Mass Spectrometry
This is a much **more sensitive** form of mass spectrometry which allows the Mr of a substance to be determined to **several decimal places**. Precise atomic masses are always given and can then be used to calculate the molecular formula of the compound being tested.

3.3.6.3 - Infrared Spectroscopy

This analytical technique uses **infrared (IR) radiation** to determine the **functional groups** present in organic compounds. The IR radiation is passed through a sample where the different types of bonds **absorb** the radiation in different amounts. These varying amounts of absorbance are **measured and recorded** allowing certain bonds and therefore functional groups to be identified.

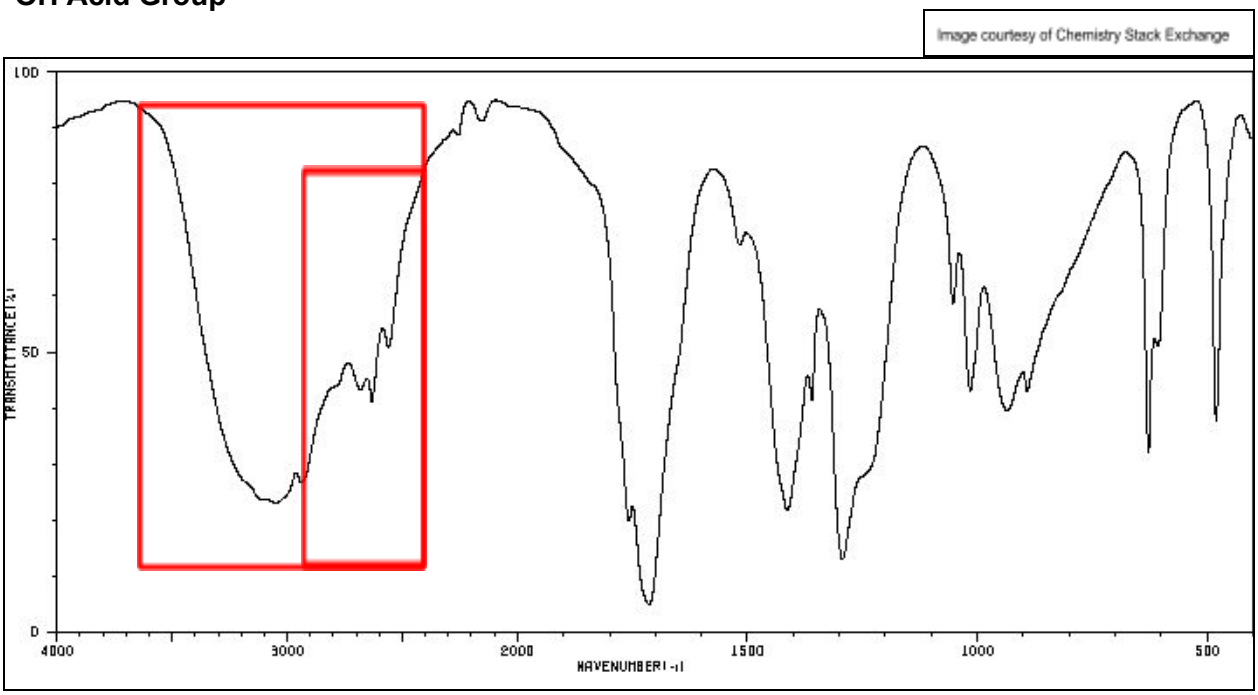
A **spectrum** is produced from the measurements which has **characteristic curves** for the different functional groups:

-OH Alcohol Group



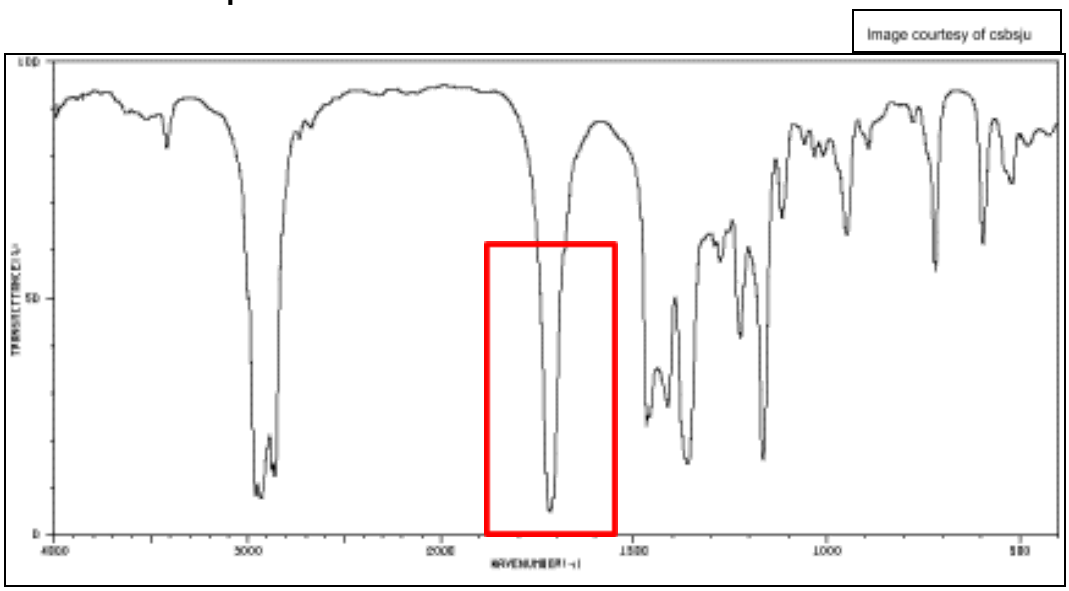
The characteristic peak is in the range 3230 - 3550 cm^{-1}.

-OH Acid Group



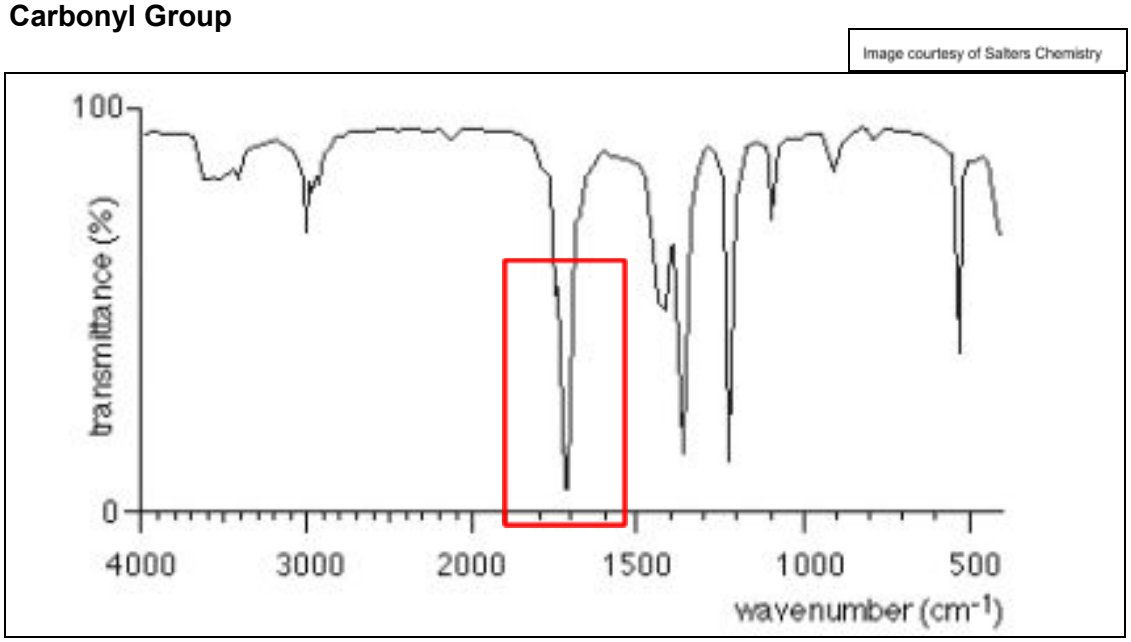
The characteristic peak is in the range 2500 - 3000 cm^{-1}.

C=C Unsaturated Group



The characteristic peak is in the range 1620 - 1680 cm^{-1}.

C=O Carbonyl Group



The characteristic peak is in the range 1680 - 1750 cm^{-1}.

Fingerprint Region

Each IR spectrum has a **fingerprint region** to the right-hand side. This contains **tiny differences** from species to species which act as a molecules 'fingerprint', allowing it to be **identified**.

Global Warming

Infrared absorption also occurs in the atmosphere with molecules such as **ozone**. This causes **heat to be trapped** within the Earth's atmosphere, an important factor for the existence of life here. However when chemicals such as CFCs are released into the atmosphere from human activity, this heating effect is **enhanced**, leading to **global warming**.