



SILVER AWARD PROJECT IDEAS



typically 30 hours of project work



Measuring alcohol content

Before you start your investigation you should carry out a risk assessment and have it checked by your teacher. For help with this, read through our health and safety information and look out for health and safety warnings in the text.

The aim of this project is to investigate the properties of alcohol/water mixtures, and how these properties can be used to measure alcohol content. The alcohol in drinks is ethanol, C_2H_5OH . However, the ethanol you use in the laboratory has been 'methylated' by adding 5% of methanol, CH_3OH . This avoids having to pay duty, because methanol is toxic, so methylated ethanol is not drinkable.



Ethanol is **HIGHLY FLAMMABLE**. Wear eye protection. Make sure there are no naked flames near the bottle and make sure a stopper is on it at all times. Have firefighting equipment close at hand - in some situations, a damp cloth can be more effective for putting out a small fire than a powerful fire extinguisher.

Getting started

Start by finding out about historical methods of measuring alcohol content. Find out about ale-conners, whose job was to test ale (connoisseur = expert or judge, in French). Using gunpowder to provide proof of alcohol content was rather more scientific. Find out what 'proof spirit' was, and the relationship between 'degrees proof' and alcohol percentage. You could try something similar using cotton wool instead of gunpowder. Devise an experiment to find out the minimum concentration of aqueous ethanol that will allow a little cotton wool to burn when soaked in the solution.



Make sure you complete a thorough risk assessment and have it checked by your teacher. Your experiments should be closely supervised by your teacher.

Using density

Brewers and wine-makers follow the progress of their fermentations by using a hydrometer to measure the specific gravity of the brew. What's the difference between specific gravity and density? Why do they change during fermentation? You should investigate how density varies with alcohol content.

- Set up a fermentation brew and measure its density as accurately and precisely as possible at intervals. (Make sure you understand the difference between 'accurately' and 'precisely'.) Use the change in density, rather than the density itself, to work out the percentage of alcohol in the brew at each reading.

- Carefully prepare ethanol/water mixtures up to 50% alcohol by volume (ABV), and measure their densities.
- Compare the readings, and suggest reasons for the differences



Remember, never consume food or drink in the laboratory.

Professional methods

You might expect professionals such as public analysts to use instrumental methods. Try to arrange a visit to a local organisation that uses analytical instruments, (not necessarily for alcohol). You don't need to understand how the instruments work, just what type of information various instrumental techniques give. This should help you to decide which technique is most suitable for measuring the alcoholic content of a drink. Your contact may be able to arrange to analyse some of your samples.

In practice, instrumental methods are not often used for alcohol content. Find out the usual method for determining the percentage of alcohol in drinks to decide how much duty is payable and to check whether a bar is watering down the spirits it sells. Compare it with the methods you used above.