CREST AWARDS

SILVER AWARD

MEASURING ALCOHOL CONTENT

30H Typically 30 hours of project work
Recommended for 14-16 year olds

Practical project

Investigate the properties of alcohol/water mixtures, and how these properties can be used to measure alcohol content.

#chemistry
#food
#alcohol

HOW TO RUN CREST USING THIS ACTIVITY

Entering your project without a teacher or facilitator? No problem! You can enter your work yourself by following this link: **www.crestawards.org/sign-in**

Looking for some support? Find a mentor by contacting your local STEM Ambassador hub: **https://www.stem.org.uk/stem-ambassadors/local-stem-ambassador-hubs**

To use their project to achieve a CREST Silver Award your students will need to:

- **Develop and lead the project**
- **Complete a minimum of 30 hours of project work**
- **Consider the broader impact of their project and demonstrate an innovative approach**
- **Write a project report or portfolio of evidence**
- **Reflect on their work during the project using a student profile form**

Preparation

Ready to get going with CREST? Sign up for a CREST account here: **www.crestawards.org/sign-in**

Create a new Silver Award project with the name(s) of the student(s) and the title of the project. If you don't have the details yet, you can fill these in later!

Run the project

We have some super handy workbooks and profiles for your students to use when running a CREST Award. You can download these when you create your CREST account by following the link above.

Encourage your students to use the Silver student guide to plan and carry out their project. Each student involved in the project should complete their own profile form.

You don't want all their good work to go to waste, so be sure they keep a record of all their amazing progress. Keeping a regular project diary will save them precious time when writing their final project report.

Make sure you consider safety and risks!

Reflection

So, your students have been hard at work and completed their CREST project, but don't let this be the end of their learning. At the end of the project, each student should complete a Gold profile form and communicate their project. This is a chance for them to reflect on all the interesting things they've learnt and the invaluable skills they have used.

Students working in a group can either submit a joint report or separate reports, but they must each complete a profile form.

Use the CREST criteria on the profile form to help the students check that they have included everything in their report.

Enter your project for a CREST Gold Award

Hard work deserves a reward! Celebrate and certify your student's achievements by entering their project for a CREST Silver Award. Simply:

Log in to your CREST account at **www.crestawards.org/sign-in**

Select your project and upload the profile form per student, project report and other evidence, such as pictures and diagrams.

Finally, complete the delivery and payment details for assessment and to order your snazzy certificates.

Congratulations on submitting for CREST Silver!

What next?

Is university on the horizon for your students? They can use their project to help demonstrate their newly found STEM skills and knowledge in UCAS personal statements.

The scientific discovery doesn't need to end here. Students can have a go at the next level up – CREST Gold.

Don't keep all the fun to yourselves, encourage others to take part in CREST projects and share the wonder of science. For free ideas on how to get started, see **www.crestawards.org**

STUDENT BRIEF

SILVER AWARD

Measuring alcohol content

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.

Getting Started

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.

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

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.

Things to think about

Find 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.

Useful Resources

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.

STUDENT BRIEF

SILVER AWARD

Health and Safety

Science project work is both dynamic and exciting but can also carry some risk. To avoid any accidents, make sure you stick to the following health and safety guidelines before getting started:

- find out if any of the materials, equipment or methods are hazardous;
- assess the risks (think about what could go wrong and how serious it might be);
- decide what you need to do to reduce any risks (such as wearing personal protective equipment, knowing how to deal with emergencies and so on);
- make sure your teacher agrees with your plan and risk assessment.

Remember, never consume food or drink in the laboratory.

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.

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

Remember!

Science isn't just about data. The most successful projects will demonstrate good communication skills and show original ideas that address a real-world problem.

Look at the world around you and consider all the innovative ways that you could address the challenge. Even if things go wrong, use this to show what you have learned. Don't forget to use the student profile form to help structure your project.