

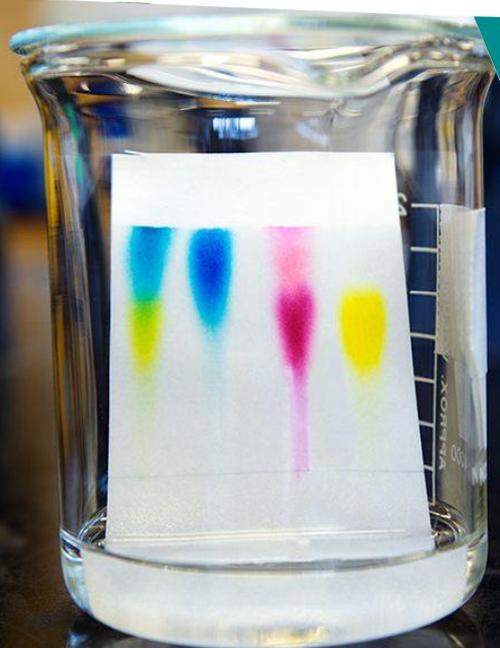


SILVER AWARD

DETECT FRAUD USING CHROMATOGRAPHY



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



**Practical
project**

Use chromatography to detect fraud.

#chemistry

#materials

#crime



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
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Detect fraud using chromatography

Chromatography literally means 'colour writing'. The results of an analysis are 'written' as a series of coloured spots. The positions of the spots help the analyst to decide what the original sample contained. If the results aren't what they should be, something is wrong – maybe a fraud. One advantage of chromatography is that it needs only tiny samples for testing. In this project you will use chromatography to detect forged cheques and other documents and various types of counterfeit goods.

Getting Started

Checking cheques: Banks advise customers to leave no gaps when writing a cheque, to make it more difficult to alter the words and numbers, however, we all make mistakes. To correct a mistake, you need to alter the writing and sign the alteration. So, what's to stop a fraudster altering a cheque and forging the person's signature? The fraudster will use a different pen. The ink may look the same, but chromatography can detect the difference. Your first challenge is to devise a reliable method of using chromatography to decide whether the writing on a cheque has been altered using the same or a different pen.

Find out about relative frequency values, and how they can be used. Try out your method using real cheques rather than plain paper, so you can see the effect of the coloured background.

Dodgy documents: It's not only cheques that are open to forgery. With modern office equipment, almost any document can be copied – certificates, passports, visas etc. Once again, detecting differences in the inks is one way to spot forgeries. All colour printers use three transparent inks (cyan, yellow, magenta) plus black, but same colour doesn't necessarily mean the same dyes. Print the same multicoloured document on several different makes / models of printer:

- Experiment to find the best solvents to extract the inks and run TLC plates. Make sure the solvent is safe.
- Compare the inks from the same part of the document printed on different models. Are any particular shades of colour better than others for showing up differences?
- Investigate whether it is possible to deduce which make and/or model of printer was used to print a document.
- What difference does it make if the document was printed on a printing press? Why?

Things to think about

How will you extract the two inks from the cheque and which solvent will you use to run the chromatogram? Are the solvents safe?

Will the colour-printed background on the cheque affect your method and/or results and if so how you will deal with this problem?

What are the relative advantages and disadvantages of using paper chromatography and thin layer chromatography (TLC)?

How can you match the forgery with a particular pen belonging to a suspect?

Useful Resources

You should try to make contact with professionals involved in this type of detection work, for example trading standards officers, public analysts and forensic scientists. Find out about the chromatographic techniques that they use, and compare them with your own methods.

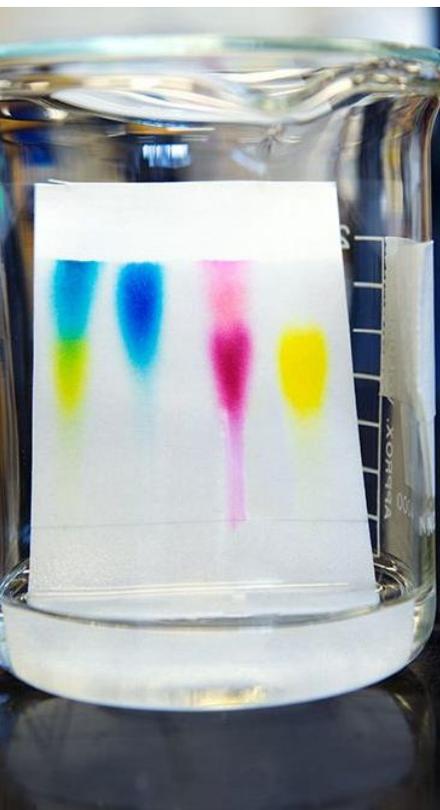
Antique antics: Genuine antiques have rarity value and are expensive. Reproduction antiques (modern copies) are much cheaper. They can be made to look old, even though they are newly made. What if an unscrupulous dealer tried to pass off a reproduction Persian carpet as an antique? How could you tell? A reproduction carpet is probably dyed with modern dyes – a genuine antique carpet cannot be. So, analysing the dyes is the key. Even if you are lucky enough to have an antique carpet at home, don't cut bits off it for this investigation! You can study the principle using samples from a carpet shop. Find carpet samples whose colours match the colours of some household fabric dyes.

Your task is to determine whether the dyes in the carpet fibres are the same as the fabric dyes.



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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.

Make sure you think about safety issues when choosing solvents for all the chromatography experiments. Many solvents are hazardous.

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.