The Body in the Laboratory

Curriculum links

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<th>KS3 Chemistry NC</th>
<th>• Pure and impure substances</th>
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<td>KS3 Working Scientifically NC</td>
<td>• Interpret observations and data, including identifying patterns and using observations, measurements, and data to draw conclusions</td>
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<tr>
<td>GCSE Chemistry NC</td>
<td>• Recall that chromatography involves a stationary and mobile phase, and that separation depends on the distribution between the phases • Interpret chromatograms, including R_f, measuring values</td>
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<td>AQA GCSE</td>
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Outcomes table

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<th>Band</th>
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<td>Developing</td>
<td>• Name a technique to analyse ink</td>
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<td>• Describe one way in which a chromatogram produced is similar to, or different from, a given chromatogram</td>
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<td>Secure</td>
<td>• Describe how chromatography separates dyes in ink</td>
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<td>• Interpret chromatograms produced to decide which is most similar to a given chromatogram</td>
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<td>Extending</td>
<td>• Explain how chromatography works to separate dyes in ink</td>
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<td>• Evaluate the strength of the evidence obtained from chromatography</td>
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Lit/Key words

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<tr>
<th>Literacy</th>
<th>Students communicate scientific information to the public by writing a leaflet to explain to the jury in a court of law how chromatography works.</th>
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<td>Key words</td>
<td>chromatography, stationary phase, mobile phase</td>
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<td><strong>Starter</strong></td>
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| **What is chromatography?** (10 min)  
If students have not met chromatography before, demonstrate the chromatography of a coloured felt tip pen. Tell students that the felt tip pen ink is a mixture of dyes, and that chromatography can be used to separate the dyes because they travel different distances up the paper in a given time. | **Extension:** Students use the particle model to explain how chromatography works. | |
| **Crime-solving chromatography** (5 min)  
Introduce the scenario as described in the introduction to the practical sheet. Then ask student pairs to discuss how they could use chromatography to obtain evidence from the pens found in the suspects’ pockets. Take feedback. | | |

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| **Chromatography and the body in the laboratory** (20 min)  
If you did Starter 1, introduce the scenario as described in the introduction to the practical sheet. Students then follow the instructions on the practical sheet to compare the ink samples from pens found in suspects’ pockets to the ink used to write the death threat. The questions guide students in interpreting their results. | **Extension:** The practical sheet asks students to consider further evidence they could collect from the pen or the note to solve the crime.  
**Support:** Activate 2 student book – Topic 2.6: Chromatography provides information and questions relating to this lesson. | **Practical:** Chromatography and the body in the laboratory |
| **Explaining chromatography** (20 min)  
Tell students that their chromatography evidence will be presented in court. They need to make a leaflet to explain to jurors how they have used chromatography to interpret evidence about the crime. Ask students to include information about the stationary and mobile phases: the distance that a given substance in a mixture travels depends on how well it dissolves in the mobile phase (in this case, water), and how strongly attracted its particles are attracted to the stationary phase (in this case, paper). | | |

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| **How strong is the evidence?** (5 min)  
Ask student pairs to discuss their answers to question 3 on the practical sheet. Take feedback and establish that the evidence, taken alone, does not prove the identity of the murderer. Then ask extension students — and others — to share their ideas about what further evidence could be collected from the pen or note to help to find out who is the murderer. | | |
| **Explaining chromatography** (10 min)  
In pairs, students read each others’ leaflets from Main 2. They peer-assess the leaflets, stating two things that have been done well, and making one suggestion for improvement. | | |

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<td><strong>Students create a presentation to explain chromatography to jurors in a court. If students have completed Main 2, the presentation can be used to complement the leaflet they have already produced.</strong></td>
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Chromatography and the body in the laboratory

It was the lab technician who discovered Dr Donny’s body on the laboratory floor and called 999. When Detective Leroy arrived, he looked for clues. In Dr Donny’s pocket was a handwritten note - someone had threatened to kill him.

By the end of the day, Detective Leroy had arrested three suspects: Victor Volt, Polly Punnett, and Ali Alkane. Each suspect had a pen in their pocket. Did one of them write the note?

Aims

In this practical, you will:

- make a chromatogram using the ink from each suspect’s pen
- compare your chromatogram to a chromatogram obtained from the death threat note to help you to decide whose pen might have been used to write the note.

You will be working scientifically to:

- use appropriate techniques in laboratory work
- interpret observations and data
- use observations to draw conclusions.

Safety

- Wear eye protection.
- Tell your teacher immediately if you break anything.

Equipment and materials

- Chromatogram of the ink from the death threat note
- A pen from each suspect: Victor Volt, Polly Punnett, and Ali Alkane
- Chromatography paper
- Pencil
- Ruler
- Glass rod (or another pencil)
- Sticky tape
- Glass beaker, 250 cm³
- Distilled water
Method

1. Use a ruler and pencil to draw a line 1 cm from the bottom of the chromatography paper.
2. Draw three pencil crosses at least 1 cm apart on the pencil line. Label each cross – V (Victor Volt), P (Polly Punnett), and A (Ali Alkane).
3. Using Victor Volt’s pen, draw a dot of ink on cross V. Using Polly Punnet’s pen, draw a dot of ink on cross P. Using Ali Alkane’s pen, draw a dot of ink on cross A.
4. Take the piece of chromatography paper and hold it in the beaker, so that the edge of the paper nearest the pencil line is just above the bottom of the beaker.
5. Use sticky tape to stick the top of the paper to the glass rod (or pencil). Make sure the bottom of the paper is still just above the bottom of the beaker.
6. Take the paper out of the beaker.
7. Pour distilled water into the beaker, to a depth of 0.5 cm.
8. Place the bottom of the chromatography paper in the water, making sure that the pencil line is above the water. Rest the glass rod across the top of the beaker.
9. Wait while the water moves up the chromatography paper.
10. When the water is 1 cm from the top, lift out the paper and glass rod.
11. Put the piece paper - your chromatogram – in a warm place to dry.
Results

Stick your chromatograms here, or draw a copy of it.

Questions

1 Your teacher will provide you with the chromatogram from the threatening note. Compare it to your chromatogram.
Write down the letter of the pen that you think was most likely used to write the note found on Doctor Donny.


(1 mark)

2 Look at your answer to question 1. Describe how the chromatogram of the pen you think was used to write the note is similar to, and different from, the chromatogram produced from the threatening note.


(2 marks)
3 Write a paragraph for Detective Leroy explaining whether the evidence from the chromatograms shows that the suspect with this pen is definitely the murderer.

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

(2 marks)

Extension

Suggest two other pieces of evidence you could collect from the pen or the note that could be used to help to find out who is the murderer.

• ________________________________________________________________________

• ________________________________________________________________________

(2 marks)
Chromatography and the body in the laboratory

Aims
In this activity/practical students will:

- make a chromatogram showing the ink from each suspect’s pen
- compare this chromatogram to a chromatogram obtained from the death threat note to help them to decide whose pen might have been used to write the note.

Students will be working scientifically to:

- use appropriate techniques in laboratory work
- interpret observations and data
- use observations to draw conclusions.

Teacher notes

- You will need to prepare chromatogram of the ink from Victor Volt’s pen before the lesson. You may wish to have more than one available so that each bench, or group of students, has access to the chromatogram to allow for easier comparison with their own chromatograms.

Answers

1. Pen V (Victor Volt) (1 mark)

2. 1 mark for similarity: e.g., the number of spots, their colours, the distances the spots have travelled up the paper. (1)
   1 mark for difference: e.g., the shapes of the spots. (1) (2 marks)

3. Award 1 mark for stating evidence does not definitely prove who the murderer is, and 1 mark for reason why. E.g., The evidence does not show that the suspect with this pen in their pocket is definitely the murderer. (1) There could be many other people with the same type of pen, for example. Alternatively, the pen may have been used to write the note, and then placed in the pocket of another person – meaning the suspect is actually innocent. (1) (2 marks)

Extension

Any two suitable suggestions: e.g., fingerprints; DNA evidence from traces such as hair, or body fluids. (2 marks)
**Technician notes**

**Safety**

- Students should wear eye protection throughout the experiment.
- Remind students to tell their teacher immediately if they break anything.

**Equipment and materials**

- Chromatogram of the ink from pen V (Victor Volt) – used to write the threatening note
- A pen from each suspect: Victor Volt, Polly Punnett, and Ali Alkane (you may wish to label these pens)
- Chromatography paper
- Pencil
- Ruler
- Glass rod (or another pencil)
- Sticky tape
- Glass beakers, 250 cm³
- Distilled water