Chem CP1a Chromatography of ink

Your teacher may watch to see if you can:

- follow instructions carefully
- draw conclusions from your results.

Introduction

Many inks contain a mixture of dyes. This method can be used to identify inks – for example inks from crime scenes or from documents that may have been forged.

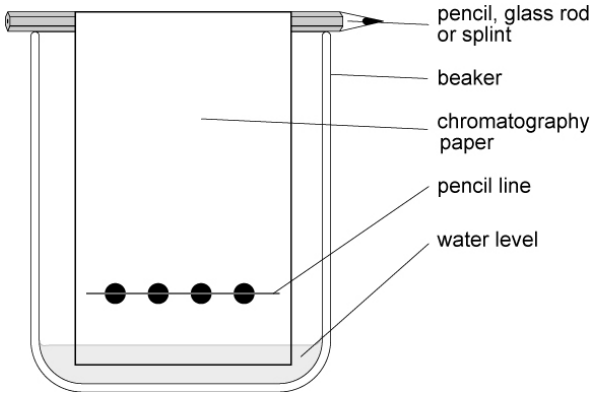
Aim

You are going to test some inks to see how many dyes they contain. You will then plan your own investigation.

Method

Apparatus

- beaker
- **chromatography** paper attached to rod
- 4 black marker pens or felt-tip pens



A Check that your chromatography paper hangs close to the bottom of the empty beaker without touching it (as shown in the diagram).

B Take the paper out of the beaker and draw a pencil line on the paper, about 2 cm from the bottom.

C Put a small spot of ink from each pen on your pencil line.

D Label underneath each spot with a pencil.

E Pour some water into the beaker to a depth of about 1 cm.

F Lower the chromatography paper into the beaker so that the bottom of the paper is in the water, but the water level is below the spots.

G Leave the paper in the beaker until the water reaches near the top of the paper.

H Take the paper out and immediately use a pencil to mark the location of the solvent front (the level the water has reached) before it evaporates. Leave it to dry.

Recording your results

1 Describe the coloured dyes that mixed to produce the black ink in each pen.

2 Measure the distance the solvent has risen from the pencil line.

3 Measure the distance that each dye spot has risen from the pencil line. Write your results in a table.

Considering your results

4 Calculate the **R_f value** for each separate colour in the four inks.

5 Were any of the black inks a pure colour? Explain your conclusion.

6 Did the same coloured dyes appear in more than one ink? If so, do you think they were the same chemical compound? Explain your answer.

Evaluation

7 Why was the starting line drawn in pencil?

8 Why did you have to label the spots?

9 Why is the chromatography paper hung with the bottom just in the water?

10 Why must the water level in the beaker be below the spots?

11 How easy was it to identify the level to which each coloured dye had travelled? How would this affect the accuracy of the R_f values you calculated?

Chromatography investigations

Now you have seen how to investigate the dyes used to make some black inks, you can use the same techniques for other investigations.

1 Choose one of the following questions:

- Do any inks used in felt-tipped pens or marker pens consist of just one dye?
- Are some coloured inks usually a mixture of more dyes than other colours of ink?
- Are similar mixtures of dyes used in the black ink in pens with permanent inks? ('Permanent' inks are those that do not dissolve in water, so you will also need to investigate the best solvent to use.)

2 Write a plan for your investigation, explaining which inks you will test and how you will analyse your **chromatogram**.

⚠ Safety

Many solvents are flammable.

3 Show your plan to your teacher before you start.

Poison pen letter

The police have been asked to find out who has been writing nasty letters to people. It is not easy to obtain ink samples from a letter, so only one chromatogram can be made using this ink. You will be allowed to look at this chromatogram.

The police have several suspects, and have taken pens from their houses. Your task is to test the ink in the pens to see if any of them match the ink used on the letter.

4 Write a plan to explain how you will try to find out if any of the pens could have been used to write the letter. In your plan you should explain:

- why you will need to calculate R_f values for the different dyes in the inks you will test
- why you need to use the same solvent and same kind of paper in your investigation as the solvent and paper used for the chromatogram made using ink from the letter
- whether or not the results of your investigation will *prove* that one of the suspects wrote the letter.

5 When you have carried out your investigation, write a short report for the police. Your evidence may be used in court, so your report should include:

- a brief description of what you did to test the inks, and how you decided if any of them matched the ink from the letter
- an evaluation of your results to show how confident you are about your conclusion.