

## **Paper chromatography**

**Big Manny:** Alright, cool.

Scientists use paper chromatography to find out what's inside an ink.

Chromatography means colour writing.

It's a separation technique chemists use every day to separate a mixture of soluble substances, like the different colours inside pen inks like this, or other coloured substances like food colourings, dyes, or even plant pigments.

I'm going to investigate how different colour dyes separate on paper, then use the chromatogram to see which dyes are in each colour.

This is the equipment you're going to need: a pencil, ruler, chromatography paper, a beaker that fits the chromatography paper, capillary tubes or pipettes for each ink, paper clip or tape, and some kind of food dye.

Food colouring can work nice for this.

Now you've got to make sure you're conducting this experiment in a classroom and using the appropriate equipment.

The dye could stain your clothes, so it's a good idea to wear a lab coat innit.

Start with a piece of chromatography paper and draw a pencil line near the bottom, that's going to be your baseline.

Use a pencil because pen ink could run or interfere with the results.

Next, place four tiny spots of ink on the line.

I used blue, red, yellow and green using a clean pipette every time.

Attach the paper to a pencil or a rod.

Dip the bottom of the paper into a solvent like water.

Make sure the water level is below the pencil line otherwise the inks could wash off.

This is a digital version of the experiment so you can see it clearly.

The line is the baseline.

As the solvent moves up the paper, it carries the different dyes with it.

Each one moves at different speeds.

This is called the two-phase system.

Mobile means moving, that's the solvent, and obviously stationary, that means still.

That's going to be the paper.

Each dye separates depending on how strongly it interacts with the paper and the solvent.

Leave it until the water has risen up the paper to about two centimetres from the top, then take it out to dry.

When the paper has dried, you can take a look at the results and that innit.

Pure substances only produce one spot.

Blue, red and yellow are all pure.

We can see that green has the most spots as it's a mixture.

It has more than one substance.

You can see it contains some blue and a bit of yellow as well.

The spots line up because they have travelled the same distance up the paper.

A spot that travels further is more soluble in the solvent and less attracted to the paper.

A spot that stays lower is more strongly attracted to the stationary phase, so it doesn't travel as far up the chromatogram.

Now it's time for a quick challenge yeah.

Over to you.

We have a chromatogram with known inks A and B plus one unknown.

What can we tell about the unknown?

From this we can identify the unknown has the same dyes as B because the spot travels up the paper to the same distance.

B is a pure substance and has one spot, yellow.

The unknown is orange, a mixture which has more than one spot, one of which is also yellow.

So even though a pen might look like just one colour, chromatography shows the hidden mix of dyes inside in it.