



Science Experiment: Document Detectives

Project: Foods, Animals, Entomology,
Collections, Wildlife, Woodworking, Etc.

Detective Challenge: Determine which brand of marker wrote the note.

Investigation 1: Ink Chromatography

What you will need for your investigation:

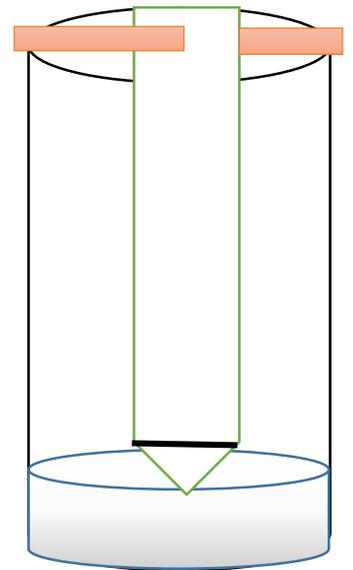
1. Coffee filter
 2. Black Marker (variety of brands)
 3. Scissors
 4. Plastic Cup
 5. Wooden coffee stirrer
 6. Alcohol
 7. Pencil
 8. Note written in black marker
 9. Safety goggles
- *Calculator and Ruler

Introduction: Ink chromatography allows us to separate and analyze the colored pigments that make up markers. Even though a marker writes in only one color, there may be hidden pigments in the marker that you cannot see. Ink chromatography will allow you to see all pigments inside of a marker by creating a chromatogram.

Steps:

1. Cut a 1" strip of paper from the coffee filter.
2. Cut the end of the strip so it makes a 'V'.
3. Choose a marker to test. Record the marker brand name:

4. Using the marker, draw a line from one side of the strip of paper to other.
5. Pour about 1" of alcohol into a plastic cup.
6. Place the pointed end of the strip of paper into the alcohol, but make sure the marker line stays above the alcohol.
7. Put a wooden coffee stirrer through the top of the strip to hold the chromatogram in place.
8. The alcohol will begin moving up the strip and will carry with it the ink pigments.
9. Wait about 10 minutes for your chromatogram to develop.



Wrapping up Investigation 1:

10. When the alcohol has finished moving up the strip of paper, remove the paper from the cup and place it on a paper towel.
11. Each brand of marker produces a different combination of color pigments.
12. View the chromatogram, record how many different colors are present : _____
13. Record the colors in the chart below.
14. Now, you will calculate the retention factor (Rf) of each color pigment.
15. Measure in millimeters from the original marker line to the farthest line where the alcohol traveled. Record this measurement in third column of your chart.
16. Calculate the same measurement for each color pigment on your chromatogram in the chart below.
17. To determine the Rf value for each pigment use this formula:
Rf value= Distance traveled by color pigment/Distance traveled by alcohol
18. Record the Rf values for each color pigment.

Chart:

Color	Color- Millimeters traveled	Alcohol- Millimeters traveled	Rf value

Answer these questions:

1. A **solvent** dissolves a substance, and a **solute** is the dissolved substance. Based on these definitions, what are the solvent and solute in this lab?
2. Which marker matched the note? How do you know? Is this enough to link a suspect to the note?

Adapted from: Presentation by Jocelyn Koller at NAE4-HA, "4-H Affordable Forensics Fun".