

Science Experiment: Document Detectives

Project: Chemistry, Science

Detective Challenge: Determine which brand of marker wrote the note using 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. Rubbing 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 for chromatography:

- 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 rubbing 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.
- 10. Repeat for each brand of marker.



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.
- 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

Reflect:

- 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?

Apply:

- 1. What skills did you use to solve the problem? How do you use these skills in other areas of your life?
- 2. How might this type of analysis be used in other situations?

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