INK CHROMATOGRAPHY

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CONTENT

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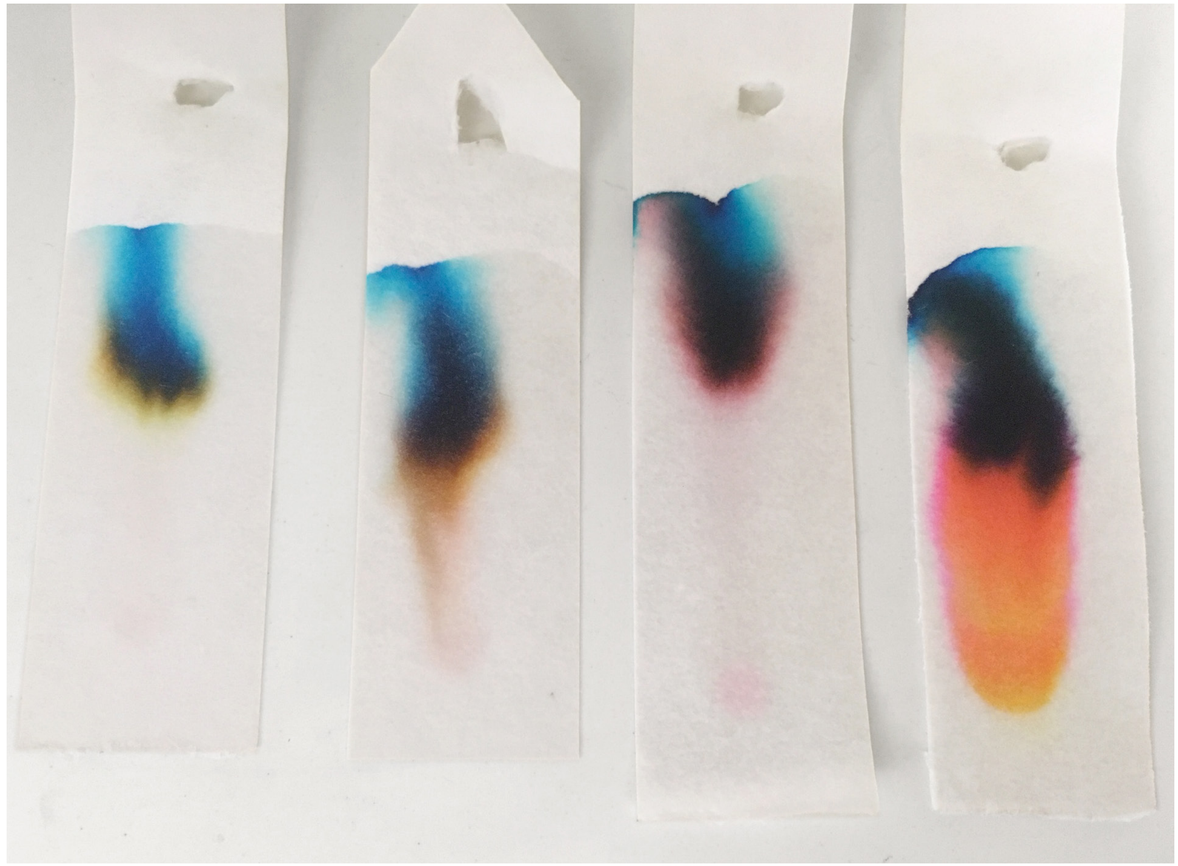
WHAT IS IT?

Chromatography is a lab technique for separating certain mixtures. We can use it to find out if the colors in our markers are made from just one pigment, or a mixture of different inks.

This is a great way to use science to explore our art supplies. It's also a great way to make art using scientific processes.



MATERIALS

You will need:

- A coffee filter or paper towel cut into strips about 3 inches long
- Small cups
- Toothpicks (optional)
- Water
- Markers: Try a few of the same color from different packs. You will likely get better results from darker colors like black. Once you've got the technique, try other colors, too!

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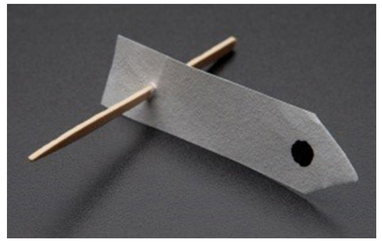
HOW TO DO IT

1. 
Choose a marker, fill in a nice circle of ink near (but not touching) one end of the paper strip.

2. 
If you are using toothpicks, push one through the filter paper, opposite the ink dot. This will stop the paper from falling into your cup. Tip: If you don’t have toothpicks, you can fold the paper over the top of the cup.

3. 
Pour just a little water into the bottom of the cup. You want the paper to touch the water, but don’t want your ink dot to be underwater. If you pour too much, don't worry! Just pour it out.

4. Keep the marker you used next to the cup—especially if you’re testing a few different markers of the same color. This will help you keep track of your ink blots.

5. Wait a few minutes and watch what happens!

WHY IT WORKS

Chromatography is a scientific process that separates substances by passing them through another medium. The ink dissolves in the water as it travels up the paper. This activity may be simple, but it still demonstrates aspects of chemistry and physics. Water is being used as our solvent, the medium our inks pass through in order to be separated. Our inks are water soluble, meaning they dissolve, or combine, with the water.

Water travels up the paper in a process called capillary motion. This happens because water molecules like to stick to each other (cohesion), but also like to stick to the molecules of the paper (adhesion). As some water molecules find new paper molecules to stick to, they bring the rest of the water with them.

Amazingly, the water also brings the ink with it! If the ink is made with just one pigment, it moves up the paper as a blob. But if it is made by mixing different colors, each color moves at a different speed—depending on how well it dissolves—and spreads out the colors along the paper.

Your finished product, a **chromatogram**, is a beautiful way to make art while doing science!

CHROMATOGRAM ANALYSIS

Once you've got the technique, you can also calculate the retention factor (Rf) of each colored pigment. Rf is a calculation that measures how far the ink travels compared to the water. It can help differentiate between ink mixtures that use the same or similar colors.

You will need:

- A ruler showing centimeters (cm) and millimeters (mm)
- A calculator (or challenge yourself with long division)
- A way to record your results (digital or pencil and paper)

How to do it:

1. Measure how far the water (solvent) traveled up the paper in millimeters.
2. Measure how far each color (solute) traveled in millimeters.
3. Divide the measurement of the solute by the measurement of the solvent to get the retention factor for each color.

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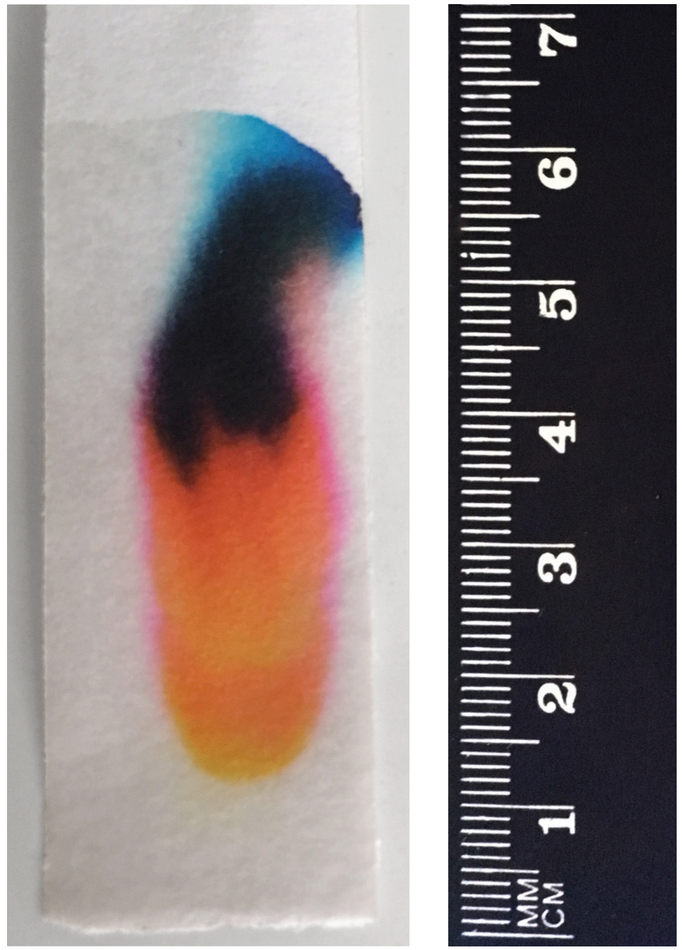
RETENTION FACTOR

RETENTION FACTOR (Rf) = $\frac{\text{distance traveled by the solute (color)}}{\text{distance traveled by the solvent (water)}}$



NEXT GENERATION SCIENCE STANDARDS

Our lesson has connections to the following standards:

Cross Cutting Concepts:

- Patterns
- Cause and effect

Science and Engineering Practices:

- Planning and carrying out invesigations
- Analyzing and interpreting data

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