It's Ink-redible!

VIRTUAL Field Trip to the California Science Center

Focus Question:

How can you show particles that are too small to be seen?

Buzzword:

Mixture

NGSS Standards

Performance Expectation:
5-PS1-1

SEP: Developing and Using Models

CCC: Scale, Proportion and Quantity

OBJECTIVE

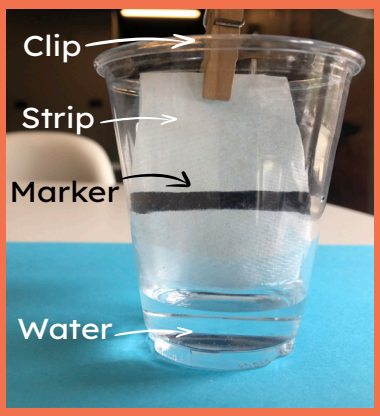
Students will conduct an ink chromatography experiment using washable markers. Using their observations, they will develop a model to help explain what happens to a mixture of ink when its particles are separated.

MODIFICATIONS

- Any washable (water-soluble) marker of any brand will work in this experiment. Different brands and different colors will produce different results, which is an opportunity for students to compare and discuss.
- For the best results, encourage students to choose darker, non-primary colors such as black, gray, or brown.
- Test strip: Napkins or paper towels of any kind can be used in place of coffee filters.
- Shallow containers work best for holding the water in this experiment, as they are less easily tipped over. However, any cup or container large enough to drape the filter over will work.
- If students are sharing water containers, have them write their name on their test strip in pencil.

NOTE: The experiment calls for washable markers because they are water soluble. Permanent marker or dry-erase markers do not dissolve in water, so the particles inside them will not separate when mixed with water.

Experiment set up:



FACILITATING THE EXPERIMENT

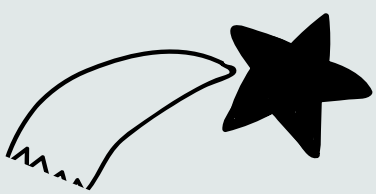
1. **Before the Experiment:** Read the situation together with the class. Allow students to share their own experiences mixing colors in inks and paints. Ask students to share their answer to the hypothesis. Accept all answers at this point, making note of any misconceptions students may have.

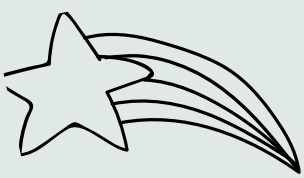
2. **Set Up the Experiment:** Each student will need a test strip, washable marker, and access to a shallow tub of water. It is okay for students to use different colors or brands of marker, though darker colors will work best. Emphasize to students that it is very important to follow the procedure exactly and to be careful not to splash or dip the "starting line" of the filter into the water. Demonstrate how to place the filter paper so that only the bottom edge touches the water. Tape, clip, or fold the excess strip over the top edge of the container so that it stays in place.

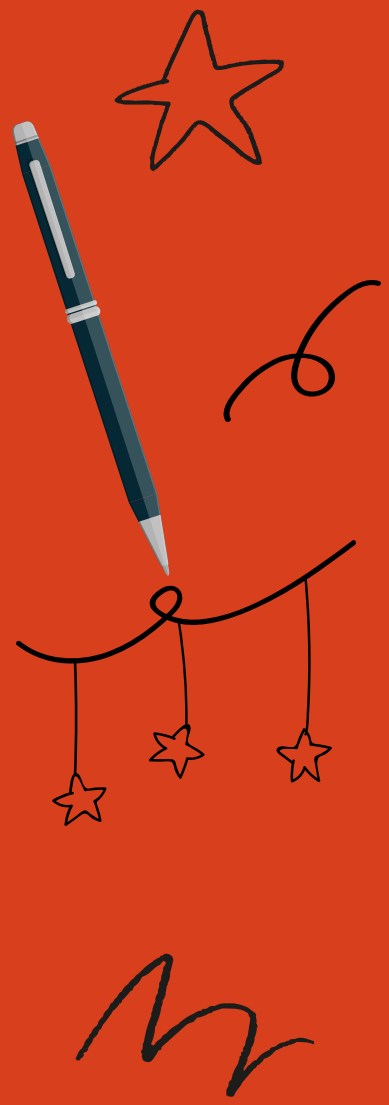
3. **During the Experiment:** Ask guiding questions to help students make more detailed observations about what is changing on their test strip. Encourage students to take notes and/or draw what they observe happening. Allow students to compare their results wtih their classmates or provide them with the image of Mariela's test strip. If time permits, allow students to gather more information by completing the activity extension on page 5.

   Guiding Questions: How does the ink change over time? Describe what happens to each color on the test strip. How do they differ? Does your test strip look like Mariela's or your classmates' strip?

4. **Wrap Up:** After the experiment, before students attempt to make their models, have a discussion about what students observed using "What's Going On?" Questions 1 and 2. After the discussion, guide students toward creating a model, or Science Sketch. They should use the criteria provided to answer the focus question with a representation of ink particles that are too small to see with our eyes.







The pattern of colors and the order in which they appear on the test strip is unique to each type of marker, and is called a **chromatogram.** Each type of marker is unique because the blend of inks used to create it are unique to that brand and color.

WHAT'S GOING ON?

1. **Describe what you saw happen to the test strip.**

   Possible student response: *When I put the test strip in the cup, water moved up the strip. When the water touched the starting line, the ink started to move up too, and new colors showed up. After a few minutes, there was a big stripe of yellow at the bottom, pink in the middle, and blue on top.*

   Guide students in making detailed and precise observations noting which colors appeared and how far along the test strip they traveled. Once students have shared their observations, help them to add scientific vocabulary to their descriptions. When the water touches the black ink at the starting line, the ink starts to spread. As the water is absorbed into the test strip, it carries the ink particles with it. Over time, the black ink separates into other colors, leaving different colors on the test strip.

   Guide students in comparing their test strips to Mariela's and/or their peers' and looking for patterns. If students used different colors or brands of markers, they will notice a different ink pattern appears.

2. **What does the experiment tell you about the particles that you can't see in black ink?**

   Possible student response: *The experiment tells me that there are many colored particles in the black ink that I can't usually see. When the water separates the ink particles, it shows the colors that are mixed to create black ink. Each color moves differently on the test strip. Some move far and some do not.*

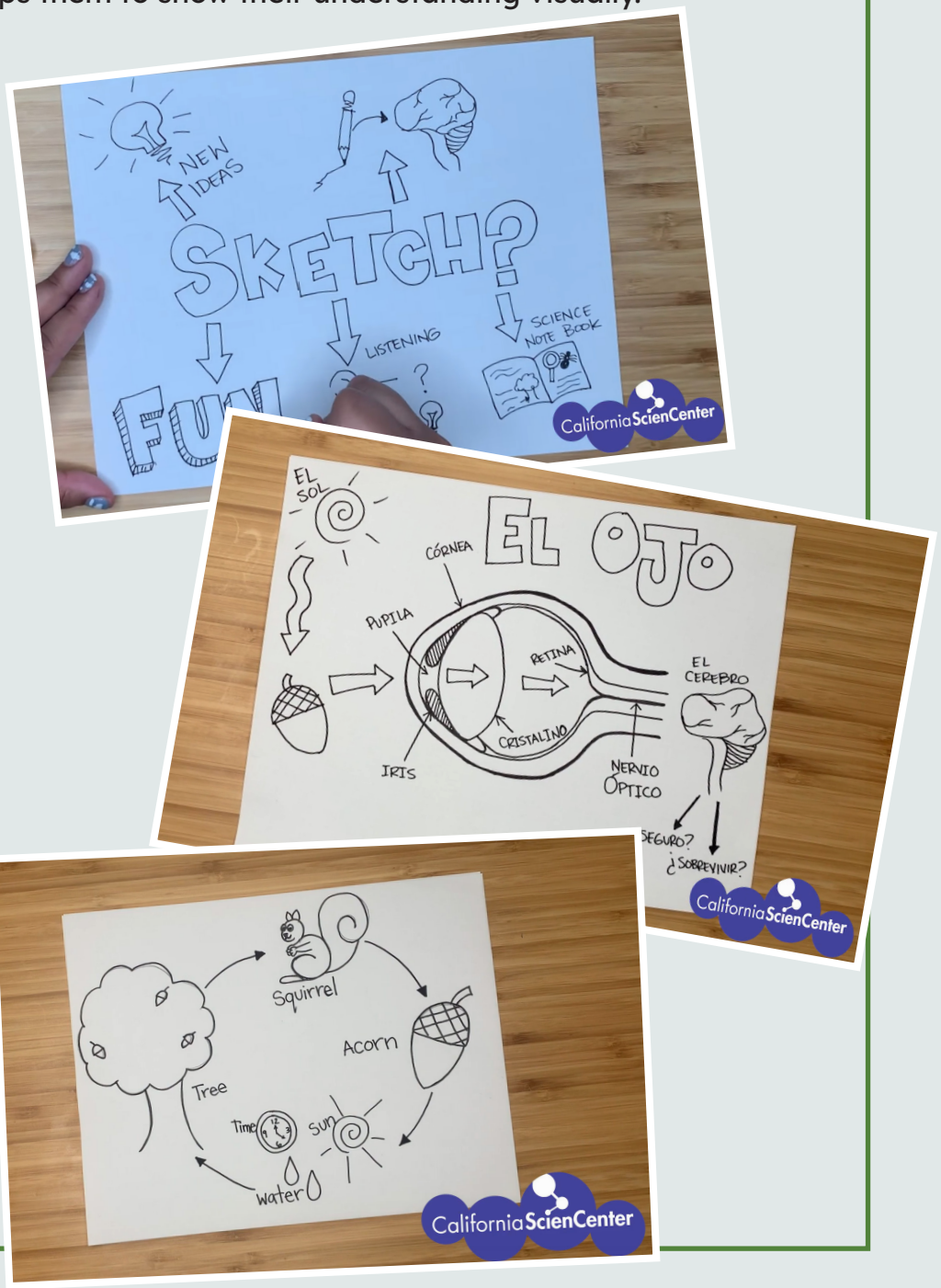
   If students do not describe the black ink as a mixture, introduce the term. A mixture is a combination of substances. In this case, a combination of different kinds of ink particles. The ink particles separate and move up the test strip as they interact with water, revealing what colors are in the black ink mixture. Students may have noticed a pattern in which colors traveled furthest along the test strip. Share that how far the colors travel tells us more about the type of ink particle we are looking at. Smaller particles move further away from the test strip, while bigger particles have a harder time moving with the water, so they stay closer to the starting line.

SCIENCE SKETCH

Student models should include:

- at least 3 different ink particles.
- labels or symbols to describe what is happening to the ink particles.

Science Sketches can take many forms! Students can use Thinking Maps, diagrams, a comic strip, or any method that helps them to show their understanding visually.



Check out Virtual Field Trip video episodes and Stuck at Home Science from the California Science Center to see some of Mariela's Science Sketches!

Additional Resources

CONNECT WITH US

Visit the California Science Center virtually or in person to explore this standard and extend the activity with related content.

- **Watch a free Virtual Field Trip video episode:** Join our educators as they investigate the difference between chemical and physical reactions to understand mixtures.
- **Reserve a live interactive Virtual Field Trip experience:** Invite our educators to visit your classroom virtually to explore air particles and how they behave and find ways to prove that particles are all around us even when we can't see them!
- **Visit us in-person:** Even particles that are too small to see can have a big effect! Learn how particles in the ocean affect visibility in our Kelp Forest exhibit in the Ecosystems Gallery.

Website: www.californiasciencecenter.org

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Share your students' experiments with us on social media for a chance to be featured!

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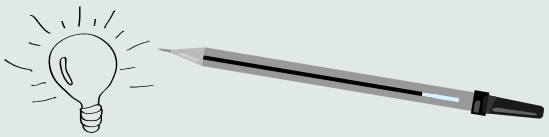
EXTENSION



Keep Testing: Test and compare multiple colors and brands of markers. Encourage students to further construct their own explanations of the "What's Going On" questions by looking for patterns across colors, brands, and types of markers. Do the separated color particles always appear in the same order on the test strip? How do primary color markers compare to secondary or tertiary color markers? Do markers that are the same color but different brands look the same? Are there any types of markers that do not separate in water?

MARIELA'S TEST STRIP

Mariela used a scented black marker for her experiment.

Look for patterns!

What similarities do you notice between Mariela's strip and yours?

What differences do you notice?