



FOR YOUTH DEVELOPMENT®
FOR HEALTHY LIVING
FOR SOCIAL RESPONSIBILITY

CHROMATOGRAPHY MYSTERIES

GRADE LEVEL: K-6

OBJECTIVES:

To increase:

- understanding of color
- ability to form hypotheses
- ability to generate creative solutions to problems
- ability to make sound judgments and conclusions
- understanding of pen/marker product design

TIME: 60 minutes

MATERIALS:

- Coffee Filters – 6 per participant
- 1/3 sponge per participant
- Plastic cup – 1 per participant
- Washable, wet erase, or dry erase markers – available for all youths
- Pencils, crayons, and/or permanent markers – available for all youths
- Water

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IMPLEMENTATION NOTES:

- This activity is designed to encourage youth to think creatively and come to conclusions based on questioning and experimentation. After introducing several concepts, youth should be capable of answering most questions with little help from facilitators.
- After this activity, youth should have a general understanding about how dyes and colors are produced in products – that often times many different pigments are used to produce a single color!
- This is a two part activity – the first part acts as an introduction to concepts, and the second part allows youth to use what they've learned to creatively solve a problem.

PREPARATION (before the session):

1. Cut sponges into thirds.
2. Set up youth stations. Each seat should have 1 plastic cup with the cut up sponge placed inside. Fill up each cup with enough water to have only half the sponge submerged.
3. Place washable/wet erase/dry erase markers as well as the pencils, crayons, and permanent markers in an easily accessible place on the tables.



At the Y, we believe in a holistic approach to youth development so that all children reach their full potential and become competent and healthy adults. **Find more activities at yexchange.org/STEM**

PROCEDURE:



1. ENGAGE AND CONNECT

 3 MINUTES

Begin by:

- Demonstrating color in markers by drawing several lines or shapes on a large piece of paper, or on a white board.
- Ask: “What colors do you see? How do you think companies are able to create these colors and use them in markers, dyes, and paints?” Brainstorm and validate youth input.



2. INTRODUCTION AND SET UP

 7 MINUTES

Give the following information:

- **Chromatography**, or **chromatics** is the study of color. We will be using chromatography to determine which color dyes are mixed together to create the colors in markers, food, clothing, and paints.
- We will also be talking about the concept of **solubility**. Solubility is a substance’s ability to dissolve in another substance – in this case, we will be talking about **water solubility**, or a substance’s ability to **dissolve in water**.

Share materials with youth and explain their purpose:

- Coffee filters will act as our canvases. We will be drawing, writing, and coloring on these filters in order to answer questions and complete challenges
- Sponges, cups, and water are our hydration centers. We will be using these in tandem with our coffee filters to determine the chromatics of the inks and answer questions about solubility. We will be able to use our coffee filters to absorb the water by folding the coffee filter so there is a point at the bottom, and poking that point into our sponge.
- Markers, pencils, and crayons are our drawing agents. We will be testing the inks in these items, as well as their solubility!



3. QUESTIONING/REASONING

 40 MINUTES

Begin the first demonstration/experiment.

- First, have youth choose three colors in WASHABLE markers and **fill out hypothesis sheet attached**. On three of their coffee filters, have them color the middle with one of their colors, a different color for each filter, then fold up coffee filter so the colored portion is folded into a point at the bottom (coffee filter will look like a slice of pie with a point at the bottom). Poke the point into the sponge, and wait several minutes. The colors will creep up the sides of the coffee filter, separating the dyes and revealing which colors were combined to make the marker ink.



3. QUESTIONING/REASONING, CONTINUED

 40 MINUTES

Before the ink reaches the outer edges of the coffee filter, have youth remove filters from the sponge and unfold. Conclude demonstration with the following questions:

- What colors do you see on your coffee filter?
- Which color traveled the farthest on your coffee filter?
- How are your coffee filters different? What does that mean about the colors that you chose?
- Why did the colors separate?

Follow up the last question with this information: the colors were able to separate and travel up the coffee filter because the markers were washable, and therefore **water soluble**.

Continue on to the activity challenge.

Present the following challenge to youth:

- You are stranded on a deserted island. You have with you a piece of paper, several markers, a pencil, and some crayons. You cannot swim to the nearest inhabited island, but you're confident that the waves and tide can pull a small container with your note to the island beach. You will want to write a message that will remain on the paper even if your paper gets wet. Use your remaining 3 coffee filters and the materials provided to determine what you should use to write your message.

Give youth time to experiment with their materials to determine which writing instruments they could use to create their message. Use the following questions to aid in discovery:

- What do you see happening to that marker when it interacts with water from the sponge?
- Why is, or isn't, the dyes of that marker/pencil/crayon separating?
- What tests are you doing to determine what writing instrument you should use?
- What writing utensil do you think you should use to write your message?

After youth have come to conclusions about their writing utensil, give each youth one more coffee filter and have them write their help message with the writing instrument they chose. Fold message into a point, place the point into the sponge, and wait several minutes. Remove coffee filter from sponge, and unfold the filter. If a youth used a permanent marker, a regular crayon, or a pencil the writing will have remained unchanged because those writing instruments are **not water soluble**.



4. REFLECTION

 10 MINUTES

Have all youth lift their message in the air, regardless of whether the message remained or not. Have youth take a minute or two to look around the room and observe their peers' messages. Then, solidify learning by asking the following questions:

- Why did some materials, like the permanent markers or pencils, remain after being exposed to water, while others washed away or separated?
- What writing instrument do you believe worked best when writing your message?
- What other materials would you like to test to determine if they were water soluble?
- Which marker inks had the most colors combined to make the marker color?
- Which marker ink surprised you by the colors used to make the ink?
- What was challenging about the activity?
- What does this have to do with you and your life?