Lab: Investigating Black Ink

FOR THE TEACHER

Summary
In this lab, students will discover that black ink is a mixture composed of several different pigments through a chromatography investigation.

Grade Level
Elementary school

Objectives
By the end of this lab, students should be able to:
- Explain what makes something a mixture.
- Understand that mixtures can be separated.
- Use the process of chromatography to separate the pigments in black ink.

Chemistry Topics
- Mixtures
- Separating Mixtures

Time
Teacher Preparation: 15 minutes
Lesson: 45 minutes

Materials
- Black washable markers (1 for every group)
- Filter paper (Cone coffee filters - you can cut 4-6 pieces from each one)
- Clear wide mouth cups filled with ~1/2 inch of water (1 for each group)
- Tape
- Large paper clip straightened out (one for each group)
- Chart paper & markers for recording student observations

Safety
- Always wear safety goggles when handling chemicals in the lab.
- Students should wash their hands thoroughly before leaving the lab.
- When students complete the lab, instruct them how to clean up their materials and dispose of any chemicals.

Teacher Notes
- Here is a summary of what happens to allow the black ink to separate during the chromatography process:
  - The ink in washable markers is made from a number of different pigments.
  - By applying a sample of ink on a very porous piece of paper, like a coffee filter and placing the edge in the water the water will travels up the paper.
When the water touches the ink sample it will carry or “pull” the pigments from the black ink along with it.

The different colored pigments will move with the water at different rates; some travel farther and faster than others.

The distance traveled by each pigment depends upon the chemical makeup of the different pigment molecules and how strongly each of the pigments is attracted to the water molecules.

This difference in attraction will allow for the ink to separate and reveal the colors that it is composed of.

- As an extension for younger students, teachers could read aloud “Mouse Paint” by Ellen Stoll Walsh or watch the YouTube video of Mouse Paint by Didi Dolan.
- As an extension for older students, teachers could actually do a more advanced chromatography investigation of candy or leaves.
- When ready to begin, I suggest playing the song, “It’s Called Chemistry” by Kim Mitzo Thompson. And have students gather as a whole group in front of the teacher.
  - Engage students by showing a black washable marker.
  - Question them by asking “Black ink is made of black ink, right?” Elicit and discuss student responses.
  - Ask, “How can we find out what it is made of?”
  - Show students the materials for the experiment: cups, water, filter papers, black markers, paperclips and tape.
  - Lead the discussion with students about how these materials could be used to explore and conduct an investigation to see if black is ink is made of only black ink or is it composed of something else.
  - Follow these procedures to conduct the chromatography separation process – see photographs for clarification. (Use a projector or chart paper display the procedures if desired):
    1. Cut the rectangular strips from the filter paper (about 3-4 inches in length, by 1-2 inches in width). Each group or student will need one.
    2. Make a mark using the black marker about a 1 inch from the bottom of the paper. Make sure to make the dot dense with ink.
    3. Using tape, attach the end of the paper that is farthest from the ink dot to a straightened paperclip.
    4. Add a small amount of water to the cup, about ½ an inch in height.
5. Place the filter inside of the cup. Be sure the black marker circle is toward the bottom and use the paperclip to keep the paper in the center of the cup (avoid having the paper touch the inside of the cup).

6. The paper should dangle into the water, and the edge of the paper should be in the water, but not the ink dot.

7. Wait, observe, and discuss what is happening to the black ink with the group.
   - During the lab ask for students’ predictions as to what they think is happening.
   - Walk, talk, share, and discuss what you see with individuals, small groups and the whole group.
   - Ask students and groups to share with the rest of the class about what they are observing. Record the student observations on a chart.

- Typical Results (After 1 minute; 3 minutes; 5 minutes final):