GIVE SPARK



GIVE SPARK · HANDS-ON SCIENCE LAB

The Secret Colors in Ink

Can two black markers contain different colors?

Teacher Guide

Grades 3–5 · Properties of matter · 55 minutes

FREE LAB

OVERVIEW

The lab at a glance

One lesson, one driving question and a mystery strip to identify from the evidence.

THE DRIVING QUESTION

Can two black markers contain different colors?

Three dots that look the same go into the water. Children find out whether they stay the same.

What children do

Pairs put a dot of ink from three different black markers onto strips of filter paper and stand the strips in a little water. As the water climbs the paper, the black ink separates into bands of color. Pairs compare the three patterns, then use them to work out which marker made a fourth, mystery strip.

What children learn

Black ink is often a mixture of several colored dyes. Water traveling through paper carries the dyes with it, and different dyes travel different distances. So the pattern a marker leaves is a property that can help identify it. Children also learn the limit of that evidence. A matching pattern supports a match among the markers they compared, and it does not rule out every other marker.

Success looks like

1. I set up every strip the same way, with the ink dot above the water.
2. I recorded the colors each ink made and the order they appeared in.
3. I named the closest match for the mystery strip and said whether my evidence gives a clear match.

What to compare

Children compare the order of the colors and their positions relative to the pencil line and the water mark. Water may travel a different distance on each strip, so the water mark matters. One shared color is not enough to claim a match, because several black inks contain the same blue or purple dye.

AT A GLANCE

Time: 55 minutes.

Grouping: pairs.

Standards link: supports NGSS 5-PS1-3, making observations to identify materials based on their properties.

SESSION PLAN

STAGE	MIN
Introduce the puzzle	5
Prepare the strips	10
Start the separation	5
Observe	15
Solve the mystery	12
Close	8
Total	**55**

THE STUDENT RESOURCE

A separate one-page PDF with the observation table, a space to sketch the four strips and the closing claim.

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PREPARATION

Get ready

What to gather, how to prepare the mystery strips and how to hang a strip so the ink climbs.

Materials

For each pair

- 3 black, water-based markers from different brands or ranges
- 3 strips of white coffee-filter paper, about 2 cm wide and 12 cm long, all cut from the same kind of filter
- 1 mystery strip, prepared by you
- 4 clear cups and a little water
- A pencil, a ruler and tape
- 4 pencils or craft sticks to hang the strips from
- The student page

Use water-based markers. Permanent markers do not work with water, because their ink does not dissolve in it.

Before the lesson

1. Label the three markers A, B and C with tape. Every pair needs the same three.
2. Prepare one mystery strip for each pair. Use the same filter paper as the children. Draw a pencil line 2 cm above the bottom and put a small dot of ink from one of the three markers at the center of the line.
3. Use the same marker for every mystery strip, write “M” in pencil at the top and keep a note of which marker you used.

How to hang a strip

1. Pour water into the cup to a depth of about 0.5 cm.
2. Tape the top of the strip to a pencil and rest the pencil across the rim of the cup.
3. Adjust the tape until the bottom of the strip just touches the water.
4. Check that the ink dot is above the water level and that the strip hangs freely without touching the side of the cup.

If the dot sits in the water, the ink washes into the cup and does not climb the paper.



Each strip gets a pencil line near the bottom and one small dot of ink on the line.

SAFETY

Marker ink stains clothes and tables. Cover the tables and lay the wet strips on paper towels to dry.

WHY PENCIL

Pencil marks do not dissolve in water, so the baseline and the labels stay where they are while the ink moves.

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TEACHING SEQUENCE

Run the lesson

Three black dots raise the question. Four strips of paper and a little water give the evidence.

Introduce the puzzle 5 MINUTES

DO Draw three black dots on the board or a sheet of paper, one with each marker.

ASK "They all look black. Does that mean their inks are the same?" Tell children they will find out what happens when water travels through the dots.

Prepare the strips 10 MINUTES

1. Draw a pencil line 2 cm above the bottom of each strip.
2. Label the strips A, B and C in pencil near the top.
3. Place a small ink dot at the center of each line, using the matching marker. Keep the three dots about the same size.
4. Let the ink dry for a minute.

Start the separation 5 MINUTES

DO Pairs hang strips A, B and C in their cups, following the four steps on page 3. They start the mystery strip at the same time.

Observe 15 MINUTES

DO Children watch the water rise and record what they see for each strip on the student page.

ASK "Which color appeared first? Does the ink make one band or several? Which colors travel farthest?"

Pairs lift each strip out before the water reaches the top. They mark the edge of the wet part in pencil straight away and lay the strip flat to dry.

Solve the mystery 12 MINUTES

ASK "Which known ink is the closest match? What features support your choice?"

1. Pairs compare the mystery strip with A, B and C. They look at the order of the colors and where each color sits between the pencil line and the water mark.
2. Each pair writes its claim on the student page, with the observations that support it and what the evidence gives them: a clear match, more than one possible match or no clear match.
3. Hear several pairs explain their claims.
4. Reveal which marker made the mystery strip.

Close 8 MINUTES

DO Discuss what made the evidence convincing or inconclusive. Children sketch their strips on the student page and tape the dry strips to the back. Allow a few minutes for cleanup within this stage.

LOOK FOR

Children who compare the whole pattern. "Both have blue at the top and pink below it" is stronger evidence than "both have blue".

IF THIS HAPPENS

Two markers give similar patterns. That is a real result. Children report that the mystery remains uncertain between those two and say what else they could compare.

An ink barely moves. Record it. That ink may not dissolve readily in water, which is a property too.

The colors run into a smear. The dot was too large or sat in the water. Start a fresh strip with a smaller dot.

WHY REVEAL LAST

Children write their claim before they hear the answer, so the writing shows their own reasoning. The reveal then checks that reasoning and not their luck.

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The science behind it

Why the colors separate, what a match does and does not prove, and how to adjust the investigation.

The science behind it

The paper is full of tiny gaps, and water creeps up through them. When the water reaches the ink dot, the dyes that dissolve in water are carried along with it. Each dye is attracted partly to the water and partly to the paper. A dye that clings more to the paper is held back and stays low. A dye that stays in the water travels farther up the strip.

Because the dyes move at different speeds, a mixture that looked black spreads out into separate bands of color. Scientists call this method chromatography, and they use versions of it to find out what a mixture contains.

A matching pattern supports a match among the samples compared. It does not prove that no other marker could produce a similar pattern. This is a useful point to make with older children, because it is how evidence works in real investigations.

Ideas children often bring

A CHILD MIGHT SAY	YOU COULD RESPOND
“The water changed the color of the ink.”	The colors were in the ink all along. The water spread them out so you can see each one.
“Black is just black.”	Ask what the strip shows. Many black inks are a mixture of several dyes.
“It matches, so we are 100 percent sure.”	It may be our closest match. Do the other samples rule themselves out, or could more than one match?

Support and challenge

Support. Give a pair pre-marked strips with the pencil line already drawn, so their attention goes to hanging the strips and observing.

Challenge. Ask children to measure how far each color traveled from the pencil line and compare that with how far the water traveled.

ASSESSMENT

Use the student page and the discussion.

Observing: records colors and their order for each strip.

Claim: names a closest match with at least two features as evidence.

Strength of evidence: says whether it gives a clear match, more than one possible match or no clear match.

TAKE IT FURTHER

Other colors. Compare brown, green and purple markers. Which are mixtures?

A different liquid. An adult can compare water with rubbing alcohol on a permanent marker, in a well-aired room.

FINAL EXPLANATION

Ask every pair for the same three things. Tell us what you found, show the evidence, and explain what you think caused it.

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Vicky Brooks
Give Spark

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The secret colors in ink

Can two black markers contain different colors?

Name _____ **Date** _____

1 My prediction

Do I think the three black inks are the same? (Yes) (No) (Not sure)

2 What we observed

Watch the water climb each strip. Write the colors in order, starting from the pencil line.

STRIP	COLORS, FROM THE BOTTOM UP	COLOR THAT WENT FARTHEST	ONE BAND OR SEVERAL?
A			
B			
C			
Mystery			

3 Our strips

Sketch your strips here with colored pencils. Attach the dry strips to the back of this page.

A	B	C	Mystery

4 Solve the mystery

We think the mystery ink came from marker _____ because

_____

_____

Our evidence gives us (a clear match) (more than one possible match) (no clear match)

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