

The Jar That Stirs Itself: Warm Water Up, Cold Water Down

Learning target: I can observe how warm and cold water move inside still water, record what I notice and wonder, and write a first explanation for why heating makes matter move.

Phenomenon exploration

About 30 min

Individual

MS-ESS2-1 · practice

discussion

writing

visual modeling

Name _____

Date _____

Period _____

Directions

Read the description of the two trials and study the figure and the observation log. Do not look anything up yet; this sheet is about what you notice and what you already think. Write in complete sentences. There are no wrong answers in Parts A and B, but every answer must be specific: name colors, directions and times from the log.

You will need: This worksheet, Pencil, Colored pencils for the margin sketch (optional)

The phenomenon

A science teacher fills a tall, clear glass jar with tap water and lets it sit on the desk for an hour so it is completely still and at room temperature (about 21 °C). In **Trial 1** she lowers a small, thin plastic pouch of warm water (about 45 °C) dyed red to the bottom of the jar and snips it open with long scissors. In **Trial 2**, in a fresh jar of still room-temperature water, she opens a pouch of cold water (about 4 °C) dyed blue just under the surface. A student films both trials and writes down what the dye does at each time. Nothing stirs the jar in either trial.

Two pouches, two directions

Trial 1: warm red water (45 °C) opened at the bottom

A red column rises straight up through the clear water

At the surface the red spreads sideways into a thin layer

The edges of the red layer slowly drift back down the sides

The bottom of the jar is nearly clear again

Trial 2: cold blue water (4 °C) opened at the top

A blue column sinks straight down through the clear water

At the bottom the blue spreads sideways into a thin layer

The blue layer stays at the bottom; nothing rises

The top of the jar is nearly clear again

Where each dyed pouch was opened and what the water looked like 40 seconds later. The temperatures and times are a teaching scenario written to be realistic; they were not measured in a real lab.

Observation log (teaching scenario)

Simulated teaching dataset: the numbers are invented to be realistic, not measured.

Time after opening the pouch	Trial 1: warm red water at the bottom	Trial 2: cold blue water at the top
0 s	Red cloud sits at the bottom of the jar	Blue cloud sits just under the surface
5 s	A red plume lifts off the bottom and heads upward	A blue plume drops away from the surface and heads downward
15 s	Plume reaches the surface and mushrooms sideways	Plume reaches the bottom and spreads sideways
40 s	Thin red layer across the top; edges start sliding down the sides	Thin blue layer across the bottom; top of jar clear
90 s	Faint pink streaks drifting down near the glass; red layer thinner	Blue layer unchanged; faint blue haze only near the bottom
180 s	Jar is a pale, even pink	Jar still has a clear top and a blue bottom

A teaching dataset: the times and descriptions were written to match what warm and cold water really do, but they are not measurements from a real jar.

Part A: Notice

1. Fill in the table using only the figure and the observation log. Use direction words (up, down, sideways) and times.

Which way did the dye move first?	What did it do when it reached the end of the jar?	What was the jar like at 180 s?
Trial 1 (warm red, bottom)		
Trial 2 (cold blue, top)		

2. The two trials are almost mirror images of each other, but not quite. Describe one way the end of Trial 1 (180 s) is different from the end of Trial 2, using the log as evidence.

Part B: Wonder and connect

3. Write three questions you have about what you saw. At least one must begin with *why* and at least one with *what would happen if*.

4. Where have you seen something like this before? Describe one place outside the classroom where warm stuff goes up or cold stuff goes down (for example in a kitchen, a bathroom, a lake, or the sky), and say what you think it has in common with the jar.

Part C: Your first explanation

5. Explain, as well as you can right now, why the warm red water went up and the cold blue water went down. Nothing pushed either pouch. Your explanation should say what is different about warm water and cold water, and it should mention gravity somewhere.

6. Predict: in a third trial the teacher opens a pouch of **warm** red water just under the **surface** instead of at the bottom. What do you think the red will do, and why?

7. Suppose the teacher kept a small heater under the center of the jar's bottom and an ice pack against the top of the glass the whole time. Describe the pattern of movement you would expect the water to settle into, and sketch it with arrows in the margin.

8. Scientists say that solid rock deep inside Earth slowly circulates in a pattern like the one in the jar, and that this is what feeds volcanoes and geysers. Write one question you would want answered before you could believe that, and say what kind of evidence might answer it.

Sentence frames for the explanation

If Part C feels hard, build your explanation from these frames: 'Warm water is different from cold water because ____.' 'Gravity pulls ____ down more strongly than ____.' 'So the warm red water was pushed ____ while the cold blue water ____.' 'At the top the red water ____, which is why by 180 s the jar was ____.' You can change any frame that does not match your idea.

Design the fourth trial

The log shows that Trial 1 ended with an even pink jar while Trial 2 ended with a blue layer still at the bottom. Design a fourth trial that would test whether this difference is caused by the temperature of the dyed water or by where the pouch was opened. State what you would change, what you would keep the same, what you would measure or film, and what result would support each explanation. Then explain why a single trial can never settle the question.