

One Drop, Two Glasses: Why Does Dye Spread Faster in Warm Water?

Learning target: I can record careful observations of dye spreading in cold and warm water, connect them to what I already know, and write a first explanation that I can test later.

Phenomenon exploration

About 30 min

Individual

MS-PS1-4 · supports

discussion

writing

visual modeling

Name _____

Date _____

Period _____

Directions

Read the scenario and study the figure and the observation log. Do not look anything up yet. Part A asks only for what you notice; keep opinions out of it. Part B asks what you wonder and what you already know. Part C asks for your first explanation. It is fine to be unsure. A first explanation is a starting point that the rest of the chapter will test, not a final answer.

You will need: This worksheet, Pencil, Colored pencil for the dye particles (optional)

The scenario

Priya filled two identical clear glasses with the same amount of tap water. She left one glass in the refrigerator overnight and warmed the other one in a bowl of hot water until a thermometer read 45 °C, about as warm as a hot bath. She set both glasses on the table and waited until the water in each was completely still. Then, at the same moment, she let one drop of blue food dye fall into the middle of each glass. She did not stir, bump the table, or touch the glasses. She watched and wrote down what she saw at set times.

Same dye, same water, different temperature

Cold glass (4 °C)

Drop sinks as a tight blue thread

Blue stays in a cloud near the bottom

Edges of the cloud spread slowly

After 5 minutes, top half still clear

After 20 minutes, faint blue almost everywhere

Warm glass (45 °C)

Drop breaks apart into wisps right away

Wisps curl upward and sideways

Blue reaches the top within a minute

After 5 minutes, evenly blue, no streaks

Stays evenly blue for the rest of the hour

Both

No stirring and no bumping

The dye eventually spreads through all of the water

The water never looked like it was moving on its own

What Priya saw in the two glasses. The glasses, the water volume and the dye drop were the same. Only the temperature was different.

Priya's observation log (teaching scenario)

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

Time after the drop	Cold glass (4 °C)	Warm glass (45 °C)
10 seconds	Blue thread reaches the bottom; clear above it	Drop already breaking into several wisps
1 minute	Blue cloud fills bottom third	Faint blue reaches the surface
5 minutes	Cloud fills bottom half; sharp boundary	Evenly blue
20 minutes	Faint blue nearly everywhere; bottom still darker	Evenly blue
60 minutes	Evenly blue	Evenly blue

A teaching scenario written to be realistic; the times are not measurements from a real lab. 'Evenly blue' means Priya could no longer see darker and lighter areas.

Part A: What do you notice?

1. Write three things you notice from the figure and the log. Each one must be something you could point to, not a guess about why. Start each with 'I notice...'
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2. By which check time in the log was each glass evenly blue? Use those two check times to calculate how many times longer the cold glass took.

3. Name two things that were the **same** in both glasses and one thing that was **different**. Why does keeping things the same matter if Priya wants to explain the difference?

Part B: What do you wonder, and what do you already know?

4. Write two questions this phenomenon makes you want to ask. At least one should begin with 'What would happen if...'

5. Think of a time you saw something spread or mix on its own without stirring (for example a smell crossing a room, sugar at the bottom of a cold drink, or tea coloring hot water). Describe it in two sentences. Was it faster or slower when things were warmer?

Part C: Your first explanation

Water looks still, but the dye moved through it anyway. Something in the water must be moving even when the glass looks completely calm. Use that idea in your drawing and your explanation.

6. Draw what you imagine is happening inside each glass at a size far too small to see, one minute after the drop. Use small open circles for water particles and filled circles for dye particles. Add arrows to show motion. Label which glass is which.



7. Write your first explanation of why the dye spread faster in the warm glass. Use the words 'particles' and 'temperature.' End with one sentence that says what you are least sure about.

8. Predict: if Priya adds a third glass of room-temperature water (about 22 °C), about how long will the dye take to spread evenly? Give a time between the two results and explain your choice in one sentence.

Sentence frames for Part C

If the explanation is hard to start, build it from these frames: 'Even though the water looked still, I think the water particles were _____. 'In the warm glass the particles were _____ than in the cold glass, so the dye particles got bumped _____. 'The thing I am least sure about is _____. ' You can change any word in a frame once it is written down.

Design the next test

Priya's two glasses cannot tell her whether a small change in temperature makes a small change in spreading time, or whether there is a sudden jump somewhere between 4 °C and 45 °C. Design a follow-up investigation with at least four temperatures. Say what you will keep the same, what you will measure, how you will decide the moment the dye is 'evenly spread' so that every trial is judged the same way, and what the result would look like if the relationship is smooth rather than sudden.