CLASSROOM ACTIVITY
Sinking Water

How does water behave at different temperatures? Your team's findings will help you understand the physical properties of water in the deep sea. Focus on the questions below in your investigation.

- Which is more dense, cold water or hot water?
- How might these qualities explain the temperature of water at the deepest depths of the sea?

Gather with your team and choose a captain and a note taker for today, as well as an artist to illustrate the group's findings. Before you begin your investigation, consider what you already know about water at different temperatures. Use the questions below to structure your discussion and jot down your notes in your journal.

- Imagine you are swimming in a swimming pool. Where is the coldest water? The hottest? Why?
- Would these same rules apply to the water in a lake? In an ocean? Why or why not?

The captain should appoint group members to collect the required materials while the rest of the group reviews today's procedure. Before beginning, the captain should make sure that the group has all required materials, and that everyone knows the day's procedure.

The notetaker will take notes on the group's findings for your team, and the artist will draw illustrations; but remember to record your observations and explanations in your journal for your own research notes. Include drawings in your own notes to illustrate your findings.

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MATERIALS

- cold tap water
- ice cubes
- two one-liter beakers or clear Pyrex jars
- hot tap water (110° to 115°F)
- food coloring

Note: You will need to prepare the ice cubes the day before you try this experiment. Mix water in a beaker/Pyrex jar with 10 drops of dark food coloring (green, blue, purple). Pour into ice cube trays and freeze. Your teacher may also ask you to reverse the experiment by coloring the water instead of the ice cubes; this can be done on the day of the experiment.

PROCEDURE

1. Before beginning your investigation, make some predictions about the qualities and behavior of cold water, hot water, and melting ice. Use the questions on the handout; record your ideas on the handout and in your journal.

2. Fill the beaker three-quarters full with hot water. Before adding the ice cubes, make a prediction, using your ideas from Step 1—what will happen when you place an ice cube in the hot water? Use the questions on the handout to structure your ideas.

colored ice cubes

hot tap water (110° to 115°F)

cold tap water

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3. Now gently place an ice cube in the water; don't let it splash. Observe what happens by watching from the sides of the jar/beaker (not the top). As you watch the colors move and swirl, you are watching how and where the cold water melting off the ice cube moves. (If you are using colored water and clear ice cubes, you'll need to watch how the clear, cold water moves within the colored water.) Record your observations on the handout and in your journal, and continue to observe and record your observations as the cube melts. You should move on to Step 4 while you are waiting for the ice cubes to melt.

4. Prepare another test of melting cubes, this time using one beaker of cold water next to another beaker of hot water. Fill one beaker three-quarters full with cold water and the other three-quarters full with hot water. Make a prediction, again using your ideas from Step 1—how will the ice cube melting in cold water compare to the ice cube melting in hot water? How will the water that melts off the ice cube move?

5. Place the ice cubes gently in each beaker. Observe what happens by watching from the sides of the jar/beaker (not the top); compare what is happening in each beaker. Record your observations on the handout and in your journal, and continue to observe and record your observations as the cube melts.

6. With your team, analyze the data, using the questions on your worksheet to guide your analysis. As your group draws its conclusions, make sure you are taking notes in your own journal. Include drawings to illustrate your ideas.

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GROUP WORKSHEET 1
DSV TEAM _____

GROUP MEMBERS _____

CAPTAIN _____ NOTE TAKER _____

1. Define density in your own words in the space below. Why is it important to know the density of substances? What is the relationship between density and buoyancy?

2. Make some predictions about the qualities of water at different temperatures. Which do you think is heavier, hot or cold water? Water or ice? Will the ice cube sink or float? How is sinking or floating related to density? What will happen when ice melts and cold water meets hot water? Why?

3. What did you observe after you placed the ice cube in the hot water? In what direction did the cold water move? Describe what you observed and include illustrations.

4. What conclusions can you draw about the density of the very cold water formed by melting the cube compared to the density of the hot water? Explain your answer.

5. What do you think will happen when you place the ice cube in the cold water; in other words, what will happen when very cold water meets cold water? How will this compare to the hot water and ice cube combination?

6. What did you observe after you placed the ice cube in the cold water? In what direction did the very cold water move through the cold water? How did this movement compare to the very cold water in the hot water? Describe what you observed and include illustrations.

7. What conclusions can you draw about which is more dense, the very cold water of the melting cube or the cold water in the beaker? Explain your answer.

8. What did the two experiments indicate about how the density difference between two substances affects the rate at which one substance sinks?

9. Review your predictions from Questions 2 and 5. Did they hold up? Why or why not?

10. Draw some conclusions from your experiments. What happens when cold and hot water interact? Which is more dense? How could this explain the properties of water at the surface of the ocean? How could this explain the properties of water in the deep ocean? Where and when on Earth might very cold water form at the surface of the ocean and then sink?

GROUP DYNAMICS

Comment on how each group member participated in today's discussion.