CLASSROOM ACTIVITY
Under Pressure

How does pressure work under water? As you and your team conduct your investigation, focus on the questions below. After you have completed the activity, respond to these questions directly in your journal.

- What is pressure? What types of pressures are exerted in the deepest depths of the sea?
- How must marine organisms adapt in order to live "under pressure"?
- What would happen to an organism from the deep ocean if it was brought up from the sea floor to a shallow depth? How would the speed at which an organism, moved from deep water to shallow water affect its response to the change in depth?

Before you begin your investigation, consider what you already know about pressure. Use the questions below to structure your discussion and jot down your answers in your journal.

- What does it mean to be "under pressure"?
- What does it feel like?
- As the depth of the ocean increases, why might pressure increase?
- Why would that be important for deep sea researchers?

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 note taker will take notes on the group's findings for your team, but remember to record your observations and explanations in your journal for your own research notes. Include drawings to illustrate your findings.

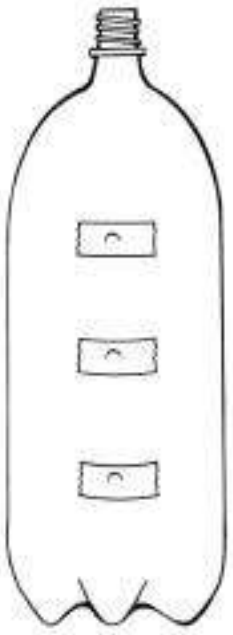
CLASSROOM ACTIVITY | Under Pressure

MATERIALS

- two-liter clear soda bottle, empty (without cap) and clean
- water to fill the bottle
- masking or duct tape, cut into three two-inch pieces
- empty sink or tub
- scissors/knife

PROCEDURE

1. First prepare the experiment. Puncture three small holes in one side of the empty soda bottle, one above the other, spaced evenly from the bottom to the top of the bottle. Don't get too close to the bottom of the bottle with the lowest hole; start at least 5 cm (2 in) from the bottom. You can use a pair of scissors or a knife to punch the holes—just be careful! Cover each hole with a piece of tape, pressing down hard. Fill bottle with water to a level approximately 5 cm (~ 2.5 in) above the top hole.



2. Now you're ready for your experiment—but first develop your hypothesis further. If the three holes are uncovered at the same time, will the water escape from the three holes at the same rate or at different rates? In other words, where will the water escape with the most force? Why? Record your predictions on your activity sheet.
3. You'll need a few team members for this next step—three to pull off the tape and at least one more to watch what happens. On the count of "three," all at once, the three tape-pullers should pull off the pieces of tape.
4. Observe how the water leaves the holes in the bottle. Each person who pulled off tape should pay extra attention to the water escaping from that hole; the fourth person can watch all the holes.
5. Discuss what happened. How did the rate of flow out of each hole compare? How did or didn't the rates of flow change over time? What do the relative rates, and how they changed over time, imply about different amounts of pressure within the bottle?
6. Discuss what you learned about pressure and how you might apply these ideas to deep sea exploration. Record your ideas on the activity sheet.

CLASSROOM ACTIVITY | Under Pressure

GROUP WORKSHEET 1
DSV TEAM _____

GROUP MEMBERS _____

CAPTAIN _____ NOTE TAKER _____

1. What do you think will happen when you pull off the tape? As the water escapes from the holes, will the rate of flow be the same or different? From which hole will the water escape with the most force? Why?

2. In the chart below, describe how the rate of flow from each hole changed as the amount of water in the bottle diminished. Did the rate change as you watched? How? When did the flow stop? Examine your description. How can you explain your observations?

DESCRIPTION	EXPLANATION
TOP HOLE	
MIDDLE HOLE	
BOTTOM HOLE	

3. Discuss the difference, if any, in rates of flow from the three holes. Out of which hole did the water escape with the most force? The least? Why might the rate of flow be different?

4. How can you explain your observations? What forced the water from the holes? How did pressure change within the bottle and at each hole as the amount of water in the bottle diminished?

5. Did your hypotheses from Question 1 hold up? Why or why not?

6. What did the team learn about pressure? Remember that pressure = force/area. Since each of the three holes is about the same diameter, and thus the same area, what must be changing in order to cause the rate of flow of the water to change from the bottom hole to the top? What causes the rate of flow from one hole to another to change over time? What is the force involved here?

7. How might these ideas apply to deep sea research? How would pressure present a challenge to deep sea researchers? How might they develop methods of dealing with that challenge?

GROUP DYNAMICS

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