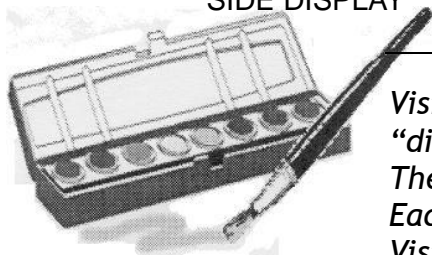
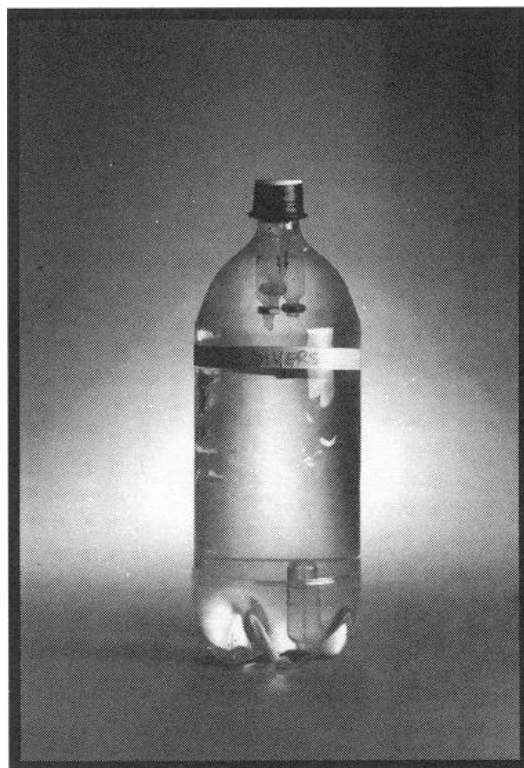


SIDE DISPLAY

# Divers



Visitors experiment with a bottle containing water and four “divers” The divers consist of open, transparent containers. The divers are weighted so that the opening points downward. Each diver has a different amount of air trapped inside. Visitors squeeze the sides of the bottle to see whether they can get the divers to sink, float, or hover.

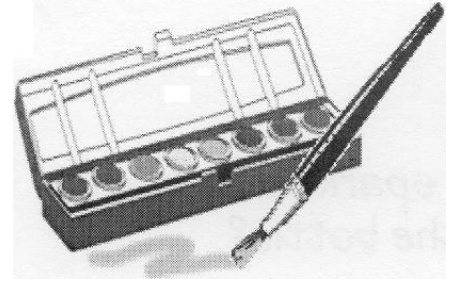


## OBJECTIVES:

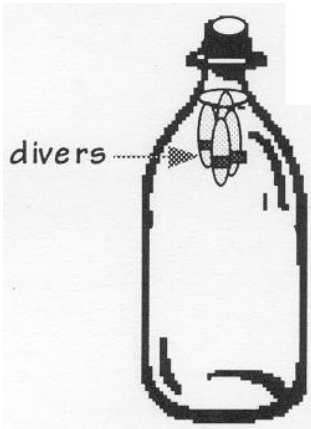
Visitors learn that the density of an object, compared to that of the surrounding water, determines whether it will float. They also learn that pressure compresses a gas.

SCIENCE TOPICS	PROCESS SKILLS	VOCABULARY
Density	Observing	Density
Pressure of a Gas	Inferring	Molecule
Properties of Gases	Investigating	
	Comparing/Contrasting	
	Predicting	

# Divers



## To do and notice:



Squeeze the sides of the plastic bottle.

- What happens to the divers inside?
- Can you get all four divers to dive?
- Can you get a diver to float halfway down?

## What is going on?

Each diver has a bubble of air trapped inside. When you squeeze the bottle, the number of air molecules in the bubble stays the same, but they get compressed into a smaller space. This allows more water to fill the diver, increasing its density (heaviness). When the diver becomes more dense than the surrounding water, it sinks. When you release the pressure on the bottle, the air bubble in the diver expands again. The process is reversed and the diver rises. (Diver 4 has the most air inside, so it is the hardest to make dive.)

Submarines carry compressed air. To make the submarine surface, air is released into tanks on the sides of the sub. The air expands, pushing water out of

the tanks. The air is less dense than the water and the submarine rises.

**MATERIALS****(with amounts to have on hand)**

- One 2-liter plastic soft drink bottle with cap
- Four jumbo plastic pipettes
- Four metal nuts with an interior diameter just smaller than the outer diameter of the stem of the pipettes
- Electrical tape

**Setup/Takedown Procedures****ORIGINAL SETUP**

- Fill the bottle to the rim with water.
- Cut the stem of each pipette, leaving about  $\frac{1}{2}$  in. attached to the bulb.
- Screw a nut onto the short stem of each pipette.
- Label the bulbs "1," "2," "3," and "4" with a permanent marker.
- Fill each bulb completely with water.
- Add an air bubble to Bulb 1 by squeezing out one drop of water. Place Bulb 1 in the top of the bottle (the water will overflow slightly).
- Add a larger air bubble to Bulb 2 by squeezing out two drops of water. Place Bulb 2 in the top of the bottle.
- Add an air bubble to Bulb 3 by squeezing out three drops of water. Place Bulb 3 in the top of the bottle.
- Add an air bubble to Bulb 4 by squeezing out four drops of water. Place Bulb 4 in the top of the bottle.
- Screw the cap securely onto the bottle.
- All the bulbs should be floating in the neck of the bottle.
- Squeeze the bottle.
- The bulbs should dive in numerical order as you squeeze the bottle harder (Bulb 1 should dive first and Bulb 4 last).
- If the bulbs are diving out of order or at the same time, add or take away air from each bulb as needed (add water by squeezing out air bubbles while bulb is under water). Also, readjust the divers if it is too hard to squeeze the bottle.
- When the divers are set, seal the cap to the bottle with electrical tape.

**WEEKLY SETUP**

- Set out the bottle and public copy in a Plexiglas holder.

**DAILY SETUP**

- Check the operation of the divers.
- Redo the original setup if needed.

**WEEKLY TAKEDOWN**

- Return the public copy and bottle to Unit 6 storage.

**RUNNING SUGGESTIONS**

- ◇ Once set up, this display should last indefinitely.
- ◇ If the bottle is vigorously shaken or turned upside down, the bulbs may need resetting, so check the operation periodically.

**EXTENSIONS**

The submarine works using similar principles.  
Send visitors on a tour of the sub.

**SAFETY & DISPOSAL**

No special precautions are needed; follow standard lab safety procedures.