Grade 6th to Grade 10th

Title: Oceanography

"Squirter"

Stating the Problem – The Big Question

How does depth affect the pressure of water?

Materials

* Sharpened Pencil
* 9-ounce(270-ml) paper cup
* Masking Tape
* 2-quart (2-liter) pitcher
* Tap Water
* Adult Helper

Planning the Procedure

1. Ask an adult to use the pencil to punch two holes of similar diameter in one side of the cup. Make one hole 3 inches (7.5 cm) from the bottom of the cup and the other hole 1 inch (2.5 cm) from the cup's bottom and slightly to the left or right of the top hole.
2. Place a strip of masking tape over the holes on the outside of the cup.
3. Fill the pitcher and cup with water.
4. Set the cup on the edge of a sink.
5. Remove the tape from the cup, and ask your helper to keep the cup filled by pouring water from the pitcher into the cup.
6. Observe the distance each stream of water squirts.

Results

Streams of water squirt out the holes in the cup. The bottom stream squirts farther.

Why?

Pressure is a force applied over an area. Since water has weight, it exerts pressure. One factor that affects the amount of pressure exerted by water is its depth. The pressure of water increases with depth because of the weight of the water pushing down from above. The greater the pressure, the farther the stream of water squirts, so the stream of water coming from the bottom hole squirts father.

This project is from Janice VanCleave's book, *Guide to the Best Science Fair Projects*, New York, Jossey-Bass Publisher, A Wiley Imprint, 1997. The Guide is available on line at: SchooDoodle.com

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Let's Explore

1. Does pressure increase equally with water depth? Repeat the experiment three times, but make only one hole in the cup at a time. First, experiment with only the top hole. Second, use only the bottom hole. Then, make a hole 2 inches (4cm) from the bottom of the cup. Design a method to measure the distance that each stream squirts, such as placing a sheet of paper under the streams and marking where they land with a ballpoint pen. Compare the distance between the top and middle streams with the distance between the middle and bottom streams to determine whether pressure increases equally with water depth.

2. Does the amount of water affect its pressure? Repeat the previous experiment, using a larger cup. **Science Fair Hint:** Use diagrams showing the distance between the streams in the small and large cups as part of a project display.

Show Time!

The second factor that determines water pressure is its density. Density is the "heaviness" of an object, based on its mass compared to its volume (the amount of space the object occupies based on its length, width, and depth). As the density of water increases, the pressure that it exerts also increases. How could the density of ocean and fresh water be compared? To find out, use 3 jars with the same mass which are large enough to hold 1 liter of water. Measure the jars to make sure the mass is the same for all three. Since you will need a sensitive scale for these measurements, ask a local pharmacist to assist you in measuring each jar in grams. Prepare the jars as follows:

- Jar 1: Leave empty. Secure lid.
- Jar 2: Fill with 1 liter (1,000ml) of tap water. Secure lid.
- Jar 3: fill with 1 liter (1,000 ml) of tap water, add 1 tablespoon (15 ml) of table salt, and stir. Secure lid.

Fill in a data table similar to the following. Use the mass and volume of each jar of water and the density equation shown to determine the density of the fresh and salt water.

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NOTE: The addition of the salt changes the volume of liquid so little that 1,000 ml will be used as the volume of the salt water.

DENSITY = MASS OF WATER ÷ 1,000 ML

NOTE: The density of water is measured in grams per milliliter (g/ml).

FRESH AND SALT WATER

Jar	Material	Mass
1	Jar + lid	
2	1,000ml fresh water + jar + lid	
3	1,000ml salt water + jar + lid	

Example

Jar	Mass
1	33g
2	1,033 g

1. Subtract the mass of jar 1 from that of jar 2 to determine the mass of 1,000ml of fresh water.

	jar 2 (1,000ml fresh water + jar + lid)	1,033g
-	jar 1 (jar + lid)	33g
	1,000 ml fresh water	1,000g

2. Use the mass and volume of the fresh water in the density equation:

Mass = 1,000 g
Volume = 1,000 ml
Density of fresh water = 1,000 g ÷ 1,000 ml
= 1 g/ml

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CHECK IT OUT!

Does pressure increase equally with water depth? Repeat the experiment three times, but Because pressure increases with depth, divers experience physical changes as they descend, or go deeper. At a depth of about 10 feet (3m), the diver's ears "pop." Find out more about the effects of pressure on a diver. What are the "bends"? How does pressure affect a diver's eyes? What equipment and methods do divers use to protect their bodies?

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