

A Sinking Suspicion

Time: 20 minutes

Topic: Density, Surface Area, Scientific Method

Type: Investigation

Overview: Students will simulate how the water level in a pool changes when large rocks are thrown from a boat in the middle of the pool.

Equipment and Materials:

600 ml beakers, weights or rocks, scissors, weigh boats (hexagonal 2.5 x 2 with clipped corners), grease pencils or transparency markers, paper towels

Objective(s):

Students will apply the scientific method.

Students will appraise the importance of working in groups.

Optional: Students will determine the effects of varying density.

Misconceptions: Putting large rocks into the water will cause the water level to rise.

Prerequisites: High School Science

Activity Table:

| Task | Reason | Notes |
|---|---|---|
| Give students a couple of min. to discuss the provided problem individually and to write their hypothesis. | To apply scientific method. | Writing it makes students commit to their hypothesis. Problem is in supplementary material. |
| Take a poll of how many say rise, stay the same, or lower. | To show how class thinks as a whole. | Most students will say rise. |
| Give students 3 min. to discuss the outcomes in groups of three. | To be exposed to collaborative thinking. | |
| Take a poll of the discussion. | To show students that discussion brings more accurate results. | Students will change from individual responses. |
| Give students 5 minutes to test their hypothesis. | To collect data. | The instructor might do this as a demonstration. |
| Discuss density and how surface area affected the outcome. | To bring closure and conceptual understanding to the investigation. | |
| <i>Optional:</i> Have students explore concept of density with the "Density Lab" provided on the given Internet site. | To enhance conceptual understanding of density. | http://www.sciencejoywagon.com/explrsci/media/density.htm |
| Discuss the importance of groups. | To emphasize that 3 heads are better than 1. | This investigation serves as an ice-breaker for the first day. |

Related Activities: Sizing up the Book

References: The investigation originated within the public domain.

<http://www.sciencejoywagon.com/explrsci/media/density.htm>

Discussion and Supplementary Material:

The Problem

There is a peculiar man in a small suburban neighborhood that keeps a rowboat in his large backyard pool. After a stressful day at work he likes to come home and take a nap in the boat where he cannot be reached. One particular day after he had rowed to the middle of his pool, he noticed several large granite rocks that had been placed in the boat most likely by some neighborhood kids. The man is impatient and needs room to stretch out for his nap and so picks up the rocks and drops them (without splashing) into the pool. What happens to the level of the water along the wall of the pool after he drops in the rocks? Does the water level go up, down or stay the same?

Students typically know from experience that placing objects in a container of water will cause the water level to rise. In this situation the rocks are already exerting a force on the surface of the water because they are sitting in a boat (this is where the water level rises). However, the question focuses on what happens when the rocks are thrown from the boat into the water. The water level actually lowers in this situation.

Materials needed

| | |
|---------------------------|---|
| 1 beaker | 1 or 2 weigh boats |
| couple of stones | absorbing mat (to absorb spilled water) |
| Water will be distributed | Laptops must be OUT of working area |

How it works

The rocks have a total mass that does not change. The mass of the rocks combined with gravity exerts a force on the boat. The boat has a certain surface area, which equally distributes the force of the rocks. The pressure of the boat on the water will cause the water to rise. When the rocks are thrown from the boat there is less force exerted on the water and the water level lowers. The reason it lowers is because the total volume of the rocks is not enough to displace the amount of water that was displaced by the pressure of the boat when the rocks were still in it. Mass and volume are related through density.

The Students

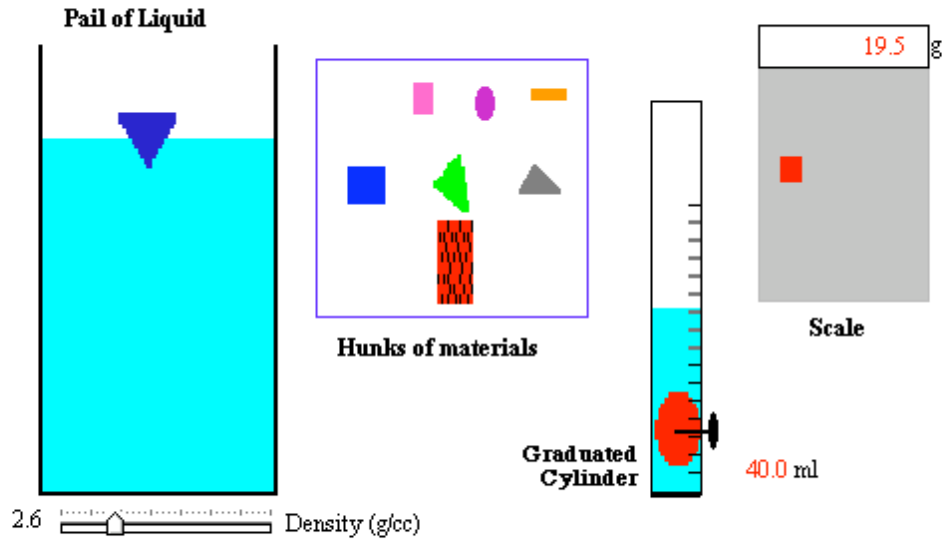
Many students will want to jump in and just see what happens. However, students should write down a hypothesis and collect data in a logical manner. The scientific method provides a logical manner in which to approach a problem.

Optional: Density Lab Activity

<http://www.sciencejoywagon.com/explrsci/media/density.htm>

This is an Internet site that allows students to find the volume and mass of various objects and then put them in a pail of liquid to see if they sink or float. The density of the liquid in the pail can be varied.

Float or Sink - You find out!



You can drag the objects to the scale to determine the mass, the beaker to measure the volume, and then put them in the pail to determine if they float. The density of water is 1 g/cc.

