

***Volume by Displacement***  
***Irregular Shapes***  
**Teacher Resource**

**Grade Level**        **9-12**

**Objectives**

1. The student will use the displacement method to determine the volume and density of an irregular object.
2. The student will employ simple equipment and tools to gather data.
3. The student will demonstrate the use of 21<sup>st</sup> century technology with an electronic balance.

**National Standards**

<a href="#"><u>NS.9-12.1</u></a>	Science as Inquiry
<a href="#"><u>NS.9-12.2</u></a>	Physical Science
<a href="#"><u>NS.9-12.5</u></a>	Science & Technology
<a href="#"><u>NT.K-12.1</u></a>	Basic Operations and Concepts
<a href="#"><u>NT.K-12.3</u></a>	Technology Productivity Tools
<a href="#"><u>NT.K-12.6</u></a>	Technology Problem-Solving & Decision-Making Tools

**Teacher Background Information**

In this experiment, the students will explore mass and water displacement. Mass will be recorded by the electronic balance and allow for the students to calculate the water displacement with an irregular object. A graduated cylinder can be used in this activity to measure the volume of the liquid, which is water. Water has a density of 1.0. The density of an object can be measured by the mass divided by the volume.

$$D=M/V$$

**MATERIALS**

Document Camera	Electronic Balance
Personal Computer	Displacement Beaker
Interactive White Board/Projector	Graduated Cylinder

Glass Beaker

Water

Food Coloring

Rock (Irregular Mass)

**PROCEDURE**

1. Measure and record the weight of the rock (irregular mass).
2. Add drops of food coloring to the water.
3. Fill displacement beaker with water until it overflows giving a baseline for measuring the amount displaced. *Note: catch the extra liquid with a beaker.*
4. Position the graduated cylinder at the overflow position and place the irregular mass into the beaker of water.
5. Measure the volume of fluid displaced by the irregular mass.
6. Now obtain the mass of the displaced liquid.
  - a. Weigh an empty beaker on the electronic balance.
  - b. Push the “tare” button in order to determine the net weight of the fluid.
  - c. Now pour the fluid into the beaker. Record the weight.
7. Clean up according to your teacher’s instructions.

**QUESTIONS****Data Table**

Object	Estimated mass (g)	Estimated volume (ml)	Actual Mass (g)	Volume of H <sub>2</sub> O in graduated cylinder	Volume of H <sub>2</sub> O & object in graduated cylinder	Object's Volume	Density (g/ml)

1. How did you determine the irregular shaped objects
  - a. Mass?
  - b. Volume?
  - c. Density?
  
2. Many objects will sink if they are denser than water, 1.0. Explain how a ship made of steel floats upon the water?

### **PRESENTATION**

Have students prepare a lab report including the data, images, and video to give a presentation on the interactive white board or projector for the class.

### **EXTENSION**

- Add other liquids besides water such as oil, liquid dish soap, etc.