

# Density of a Solid

# Teacher's Notes

<b>Main Topic</b>	Measurement
<b>Subtopic</b>	Density
<b>Learning Level</b>	Middle
<b>Technology Level</b>	Low
<b>Activity Type</b>	Student

Description: Use a graduated cylinder and balance to find the density of different solid objects.

Required Equipment	100-mL graduated cylinder, electronic balance, density blocks, water, other small irregular solid objects
Optional Equipment	Triple-beam balance

## Educational Objectives

- Find the density of solid cubes and irregular solid objects.

## Concept Overview

Density is a physical property of every object with mass and volume. Density is defined as the amount of mass in each unit of volume; i.e. grams per milliliter.

Students will measure the mass of several objects, and then find their volumes and calculate density. Regular objects such as cubes will be measured to find volume. For irregular objects, students will use the displacement method of finding volume. (The object is placed in a known volume of water. The change in total volume is the object's volume.)

## Lab Tips

Students should already be familiar with how to read volume on a graduated cylinder by looking at the meniscus. Students should also be familiar with the use of an electronic or triple-beam balance.

The accepted values of some common metals (including those in Arbor Scientific's Density Blocks set) are listed below.

Metal	Density (g/cm <sup>3</sup> )
Aluminum	2.8
Brass	8.3
Copper	9.1
Iron	6.1
Lead	11.6
Zinc	7.0

# Density of a Solid

Name: \_\_\_\_\_

Class: \_\_\_\_\_

## Pre-Lab Questions:

1. Find the volume of a cube that is 30mm on each side.
2. A cylinder contains 50mL of water. An object is placed in the cylinder and submerged. The cylinder now reads 72mL. What is the volume of the submerged object?

## Goal:

Find the density of several solid materials.

## Materials:

100-mL graduated cylinder, electronic balance, density blocks, water, other small irregular solid objects

## Procedure:

1. Your teacher will assign you three solid metal cubes. Identify the cubes in the table below by type of metal or assigned number.
2. Measure and record the mass of each cube.
3. Carefully measure the length of each side of the cubes, and calculate and record their volume. Keep in mind that they may not be perfect cubes, and each dimension should be measured.

Solid Cubes	Mass (g)	Volume (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )

4. Your teacher will provide three different irregular objects. Identify the objects in the table below.
5. Measure and record the mass of each object.
6. To find the volume, immerse each object in a known volume of water. The change in volume is the volume of the object. (If the object floats, gently push it down with a pencil so that it is completely submerged.) Record the volume of each object.

Irregular Objects	Mass (g)	Volume (cm <sup>3</sup> )	Density (g/cm <sup>3</sup> )

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Class: \_\_\_\_\_

7. Density is found by dividing the solid's mass by its volume.

$$Density = \frac{Mass}{Volume}$$

Calculate the density for each of the four columns in the table above. Don't forget to show appropriate units in your calculation and answer.

8. Compare your calculated densities to the accepted densities for the materials, if available. Are your results close to the accepted values?

9. Did any of your objects float? If so, what do you notice about their densities?