

Lesson plan for *Density*: How Does Density Relate to Mass & Volume and an Objects Interaction with Water?

<http://phet.colorado.edu>

Learning Goals:

Students will be able to use macroscopic evidence to:

1. Measure the volume of an object by observing the amount of fluid it displaces or can displace.
2. Provide evidence and reasoning for how objects of similar:
 - a. mass can have differing volume
 - b. volume can have differing mass.
3. Identify the unknown materials by calculating density using displacement of fluid techniques and reference tables provided in the simulation.

Background:

My students are in Honors Physics, a first year junior-level high school course with a pre-requisite of B or better in math and science and minimum math concurrent enrollment in Algebra II. They took Physical Science as 8th graders, so this lesson is meant to be a refresher for density and to help them think about what they already know about density and apply their ideas to how density affects how objects act/interact when placed in water.

Density Introduction:

I did not give any demonstration of the sim.

[Tips for Teachers](http://phet.colorado.edu/files/teachers-guide/density-guide.pdf) Guide for this simulation is at <http://phet.colorado.edu/files/teachers-guide/density-guide.pdf>. These seem to be very useful teacher hints:

Tips for controls:

- You can put the blocks in the water. If an object floats, you can hold it under water to measure its volume.
- Use the scale and the volume of water displaced to calculate the density of the mystery objects.
- Use the table to determine the identity of the mystery objects.

In addition, I think that my students may struggle with the behavior of the water block as is noted in the Insights into student use, so I decided to address this specifically in the lesson. I am expecting them to determine that in the "Same Mass" mode, the block will stay wherever the student puts it because the density of the blue block is the same as that of water.

Lesson:

I plan to use this as an introductory lesson to Buoyancy and followed by my activity for Balloons and Buoyancy. I have included a lab called Accuracy and Precision that could be used for a hands-on intro. There is one version that is all sim and B version of sim directions with a lab component after using the sim.