

CONCEPTUAL PHYSICS**Tech Lab****Liquids: Buoyancy****Density and Flotation Simulation**

Pool Cubes: Density

Purpose

To rank items by mass, size, density, and to determine a density-based rule for floatation

Apparatus

___computer

___PhET sim, "Density" (available at <http://phet.colorado.edu>)

Discussion

Some pieces of gold are large and some are small. They have different masses and different sizes (volumes), but they all have the same density. And while a pound of lead and a pound of feathers will have the same mass (on Earth), they have vastly different volumes because they have vastly different densities. The textbook defines density as the ratio of mass to volume:

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

In this activity, you will explore the meaning of density using simulated solid cubes, an electronic balance, and a pool of water.

Procedure

Step 1: Launch PhET sim, "Density." In the on-screen Blocks panel, select "Mystery." You should see a screen similar to figure 1.

Step 2: Use the on-screen electronic scale to determine the mass of the blocks. Record the masses on Table 1 below. Rank blocks by mass using the symbols of equality and inequality. For example, "A > B = C" would mean that A has a mass greater than that of B, and that B has a mass equal to that of C.

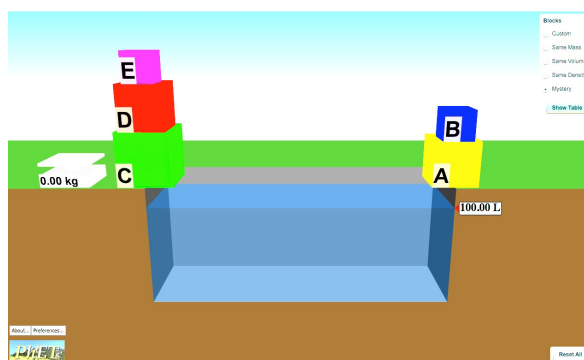


Fig. 1. PhET Density Sim

Step 3: a. Determine the volumes of the blocks and record them on Table 1. Rank the blocks by volume (size) using the notation described above.

b. What was your technique for determining volume? "Eye-balling," or visual inspection is not a sufficiently precise technique. Your technique must be valid for **all** blocks.

Table 1. Density Sim Data, Calculations, Observations, and Findings

| Block | Mass (kg) | Volume (L) | Sink/Float? | Density | Material |
|-------|-----------|------------|-------------|---------|----------|
| A | | | | | |
| B | | | | | |
| C | | | | | |
| D | | | | | |
| E | | | | | |

Step 4: Calculate the densities of the blocks. In the space below, show your calculation for the density of block A.

Step 5: Indicate whether each block will float or sink.

Step 6: Click the on-screen “Show Table” button and record the name of the material for each block.

Step 7: a. Click the on-screen “Same Volume” button.

b. What is the volume of each block? _____ L.

c. Rank the blocks in terms of their densities using the notation described above.

Step 8: a. Click the on-screen “Same Mass” button.

b. Rank the blocks in terms of their densities.

c. The blue block behaves in a manner different than any other block in this activity. Describe the peculiar behavior of the blue block.

Summing Up

1. What condition—in terms of density—determines whether or a block will sink or float?

2. Why does the blue block behave as it does?