

Lesson Implementation and Reflection

Erica Barbieri

Endeavor STEM Teaching Certificate Project

NASA Chemistry in the STEM Classroom

Prof. Brandon Rodriguez, PhD

February 2020

Density Lesson Implementation and Reflection

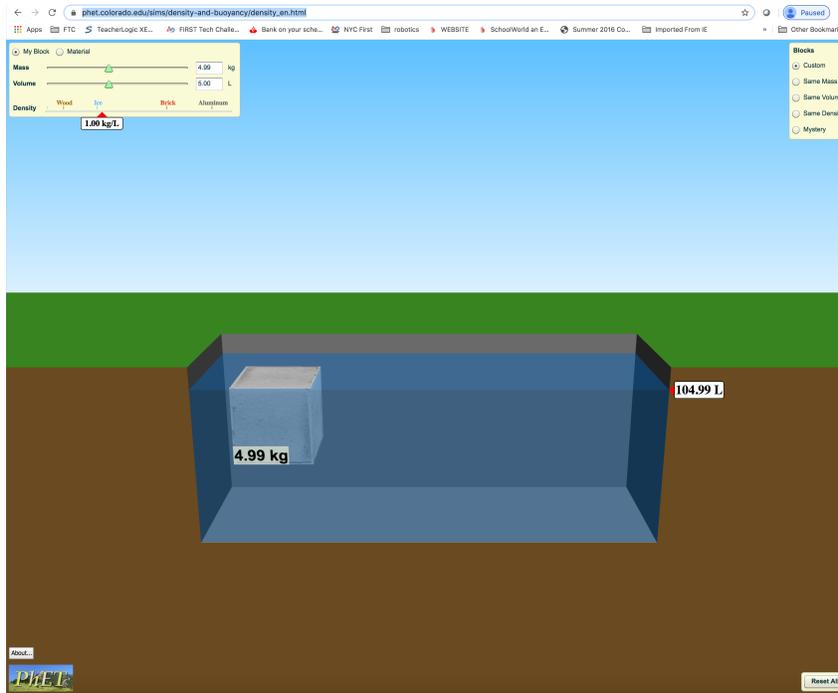
Early in this course, we were introduced to various lab simulations by PhET Interactive Solutions. Although I've taught large science courses in the past, this year my focus is mainly on art and design courses, small-group instruction for the purpose of providing educational support in core subject areas, as well as coordinating our High School Advantage Program in science and math. I chose two resources available on the PhET Interactive website: <https://phet.colorado.edu/en/simulation/legacy/density> and <https://phet.colorado.edu/en/contributions/view/5121>.

My science students this year range from grades 9 through 11 and study biology, chemistry, and earth science. For this particular lesson implementation, I had ten students (two groups of five) in 10th and 11th grade, studying both chemistry and earth science. I chose these resources because they cover required topic material relevant in both subject areas, so the groups could work together. Prior to presenting this simulation to my students, I explored it myself and found that the simple graphics were non-distracting and that it supported the basic fundamental concepts about density required by NYS Regents courses.

I chose the "Virtual Density" lab worksheet, editing only the initial instructions (see attached worksheet pages). Overall, this exercise took my students under 30 minutes to complete and most of the lab was completed with few questions in terms of functionality. In the past, I've had mixed results when using online simulations; many times they require a great deal of time to explain how to navigate the simulation and this frustrates students (particularly those with special needs). The student worksheet provided step-by-step, easy to comprehend instructions with screen shots. In fact, the only time students requested my intervention was in Part 3, when they had to enter the volume of the mystery blocks through water displacement. In the earlier stages of the lab, the volume was provided to them. Now, they had to mass the blocks, put them in the water to determine volume, calculate density, and use information from a table to determine each block's material. Once I modeled how to drag the block under the water and subtract the difference from the original water volume, they quickly edited the information in their table and recalculated the density. Both groups correctly determined the material of each block using their data and were able to explain why some objects sink and others float.

As a conclusion to this lesson, I provided students with physical objects, balances, and full sinks of water for them to predict which objects would float the best and which

would fall below the water line. They successfully ordered the objects by their densities and were able to provide explanations for their choices.



Screenshot of <https://phet.colorado.edu/en/simulation/legacy/density>



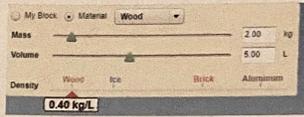
Group of 10th & 11th graders as they launched the simulation.

The following 4 images represent a completed student worksheet

Name Table 1 - Sam, Arielle, Vinny, Marvin, ... Period # _____

Virtual Density Lab

- Go to: <https://phet.colorado.edu/en/simulation/legacy/density> (Click the link on Google Classroom)
- You will see a block of wood in water.
- Using the table at the top left and clicking on the drop down menu at the top find the following information:



The screenshot shows the PhET simulation interface. At the top, there is a 'Material' dropdown menu set to 'Wood'. Below it, there are sliders for 'Mass' (set to 2.00 kg) and 'Volume' (set to 5.00 L). At the bottom, there is a 'Density' display showing '0.40 kg/L'. The interface also includes buttons for 'Wood', 'Ice', 'Brick', and 'Aluminum'.

Material	Mass	Volume	Density	Float or Sink?
Styrofoam	0.75 kg	5.0L	0.15 kg/L	Float
Wood	2.0 kg	5.0L	0.40 kg/L	Float
Ice	4.60 kg	5.0L	0.92 kg/L	Float <input checked="" type="checkbox"/>
Brick	10.0 kg	5.0L	2.00 kg/L	sink
Aluminum	13.5 kg	5.0L	2.70 kg/L	sink

- What can you say about the density and the material's ability to float?
Lower density floats.

5. Use your cursor to remove the block from the water.
6. In the table at the top left click on "My Block."
7. Use the sliders to adjust a mass and volume for a block that doesn't sink or float on top of the water. Test your hypothesis by putting the block into the water.

8. What was its mass?

4.99 kg

9. What was its volume?

5.00 L

10. What is its density?

1.00 kg/L

11. Why did it do this?

They are the same or they equal 1.00.

Part 2

1. In the box at the top right click on the bubble left of "Same Mass."
2. When you do, do they all have the same volume?
NO
3. Explain why or why not.

They are made of different stuff

Blocks

- Custom
- Same Mass
- Same Volume
- Same Density
- Mystery

Show Table

4. In the same box, click on the bubble left of "**Same Volume.**"

5. When you do, do they all have the same mass? no

6. Explain why or why not.

They are made of different stuff that could be lighter or more heavy at the same size.

7. IN the box at the top right click on the bubble left of the "**Same Density.**"

8. What can you say about the blocks now?

There different sizes or volumes.

Part 3.

1. In the box on the right click on the "**Mystery**" bubble. You will see boxes A through E, a scale, and a volume meter. Mass the blocks by putting them on the scale and recording their mass in the data table on the next page. To find their volume you might have to use your cursor to hold

Blocks

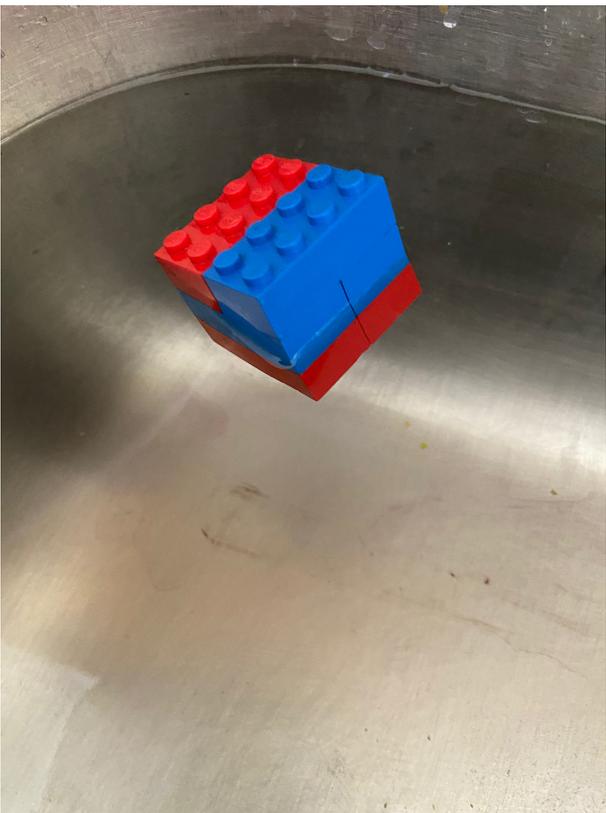
- Custom
- Same Mass
- Same Volum
- Same Densi
- Mystery

Block	Mass	Volume	Density	Material
A	65.14	13.38	19.5272	gold
B	0.64	1.08	0.64	apple
C	4.08	5.830	0.69988	gasoline
D	3.10	3.38	0.917	ice
E	3.53	1.00	3.53	diamond

3. Which of these blocks floated? C, D, and B
4. Which of these blocks sank? E and A
5. Why did they do this?

All the blocks under 1.0 floated mostly. The 3.53 and 19.272 sank.

This was the section in which students had difficulty determining the volume. Following an explanation, they were able to complete it independently.



Student images of lab follow-up/exit question.

Hewitt, J. (19AD, March 6). PhET Interactive Simulations. Retrieved January 29, 2020, from <https://phet.colorado.edu/en/contributions/view/5121>

PhET Density. (2011, March 31). Retrieved January 29, 2020, from https://phet.colorado.edu/sims/density-and-buoyancy/density_en.html