Teachers Notes, Suggestions, and Reflection

1. Materials
    a. Access to internet. I haven't had any problems with this simulation running on windows. I have also used the simulation with multiple browsers and haven't seen an issue. Check though to be sure.
2. Length of time
    a. I don't have any issue with getting this lab done in a 55 minute period.
3. Google Doc Version
    a. If you are using Google classroom or just using docs and would prefer that they type everything up and submit it digitally, here is the link to a shared version of the document. It should do an automatic request to copy.
4. Prerequisite knowledge
    a. Students don't really need to have any prerequisite knowledge, but words they need to know before going into the lab might be words like, mass, volume, density. Even though those words are discussed in the lesson.
5. What will students understand when they are finished with this lab?
    a. They will truly understand what volume and density really are. They will understand how to calculate volume and density. They will understand the units of measure for mass, density, and volume.
6. This lab is a good segue into my next lab of finding the density of rocks.
7. For the most part this is a self paced lab, where the teacher is more of the facilitator. The lab has clear instructions to it. I have found that students rarely read instructions so this lab is a good one to find out if they can or if they do. During the lab I am constantly asking students if they "read" the instructions before helping them out too much. This lab really is a step by step lab.
8. I usually allow this lab to be done with a partner. Depending on the class make up, they can choose their partner or sometimes I choose for them. If your class has an odd number of students, then just have one group of 3 or there might be somebody in the class who would prefer to do it alone. If you don't want them to work with a partner they can still easily get it done by themselves in a class period.

Phet Density Lab Teacher's Edition/Answer Key

https://phet.colorado.edu/en/simulation/density

1. **As the block of wood becomes larger, what happens to the volume of the tank?**
    a. The volume of the tank becomes more filled up. They might notice that the volume of the tank increases exactly the same amount as the volume of the wood increases. If they didn't catch that, it will be discussed more below.
2. **An object's density is .5 kg/L. Will it sink or float?**
    a. Float because density is less than 1.
3. **An object's density is .99 kg/L. Will it sink or float?**
    a. Float, but students should understand that it will barely float because density is just under 1.
4. **An object's density is 1.5 kg/L. Will it sink or float?**
    a. Sink because density is greater than 1
5. **What is the density of an object with a mass of 5 kg and a volume of 5 L? Will is sink or float?**
    a. This is a trick question. 5 divided by 5 is one. Therefore it really won't sink or float, but will remain wherever it is placed in the water. I don't reveal this answer until the end of the lab. Hopefully they will catch it before the finish the lab. Be prepared to get a lot of kids asking you about this question.
6. **What is the density of an object with a mass of 8 kg and a volume of 5 L? Will it sink or float?**
    a. 8 divided by 5 is going to be greater than 1 therefore it will Sink.
7. **What is the density of an object with a mass of 4 kg and a volume of 8 L? Will it sink or float?**
    a. 4 divided by 8 is less than one therefore the object will float
8. **Create a block with a mass of 8 kg. What is the volume of the block?**
    a. 20 kg/L

	Mass	Volume	Density
Blue	5 kg	5 L	1 kg/L
Green	5 kg	2.5 L	2 kg/L
Red	5 kg	1.25 L	4 kg/L
Yellow	5 kg	10 L	.5 kg/L

9. **Before dropping them in the water, hypothesize which ones will float. Write the color of the blocks that you think will float. Explain why.**
    a. This answer will vary.
10. **Test your hypothesis. Which colors floated?**
    a. Green, red

	Mass	Volume	Density	Sink or float?
Yellow	65.14 kg	3.38 L	19.27 kg/L	Sink
Blue	.64 kg	1 L	.64 kg/L	Float
Green	4.08 kg	5.83 L	.7 kg/L	Float
Red	3.10 kg	3.38 L	.92 kg/L	Float
Purple	3.53 kg	1 L	3.53 kg/L	Sink

Name: _____

Phet Density Lab
https://phet.colorado.edu/en/simulation/density

Google: Phet Density and click on the first link.
Click the “Play” icon to get the simulation started.

Leave the option to “Wood.” Play with the sliders for mass and volume, by sliding them left and right. Look at the numbers of both the mass of the wood block and volume of the water tank.

1. **As the block becomes larger, what happens to the volume of the tank?**

This is called “Displacement.”

A 1 g object will sink until it displaces 1 g or 1 ml of water. It does not matter the size or shape of the object. Normal water has a density of 1 g/cm^3. A 1 g object will displace 1 cm^3 of water. 1 cm^3 of water is the same as 1 g of water. Just like your simulation. When the mass of your wooden block reached 8 kg, it had displaced 8 liters of water. That is why the tank now read 108 L.

Whether an object floats or sinks depends on its density. Density is calculated by taking the mass of the object and dividing it by it’s volume. D = m/v. The closer an object’s density is to 1 g/cm^3 the object will sit lower in the water. If the density reaches 1 g/cm^3 or greater it will sink. Density can also be measured in kg/L. In this simulation we are going to be using kg/L. When doing the math and experimentation you will notice that if the density is less than 1 g/cm^3 it will float and if it is greater than 1 g/cm^3 it will sink.

2. **An object's density is .5 kg/L. Will it sink or float?**

3. **An object’s density is .99 kg/L. Will it sink or float?**

4. **An object’s density is 1.5 kg/L. Will it sink or float?**

5. **What is the density of an object with a mass of 5 kg and a volume of 5 L? Will is sink or float?**

6. **What is the density of an object with a mass of 8 kg and a volume of 5 L? Will it sink or float?**

7. **What is the density of an object with a mass of 4 kg and a volume of 8 L? Will it sink or float?**

Now that we understand how to calculate the density of an object, we need to find out how to get the mass and volume of an object. The mass is easy. We use a scale and weigh the object.

Now remember volume is how much space an object takes up. In a cubed object, you can easily find the volume by this formula: V=L*W*H. But to do so you have to take the measurements of the length, width, and height. Again if all sides are easy to measure, then calculating volume is easy. But how could you find the volume of say a rock, which has irregular sides? One way is to submerge the whole object into water and see how much water is displaced. Go back to the Phet lab and take the block out of the water. Take note as to how many liters of water there are when there is nothing in the water. Now take the block and completely submerge it. Subtract the the final volume of water from the initial volume of water and this will tell you what the volume of the object is.

$V_{displacement} = V_{final} - V_{intial}$

9. **Create a block with a mass of 8 kg. What is the volume of the block?**

On the right hand side of the Phet lab, you see a "Blocks" menu. Choose the "Same Mass" option. You should now see 4 different blocks that have the same mass, but different densities. Using the your knowledge of density, volume and mass fill in the following table. *Don't forget to use units.*

	Mass	**Volume**	**Density**
Blue			
Green			
Red			
Yellow			

Now choose the "Same Volume" in the "Blocks" menu. All of the blocks are the exact same dimensions therefore they will have the exact same volume because they take up the exact same amount of space. In this case a volume of 5 L.

11. **Before dropping them in the water, hypothesize which ones will float. Write the color of the blocks that you think will float. Explain why.**

12. **Test your hypothesis. Which colors floated?**

Now click on the "Mystery" option of the "Blocks" menu. Discover the mass, volume, density and decide whether the object will sink or float. *Don't forget to use units.*

	Mass	**Volume**	**Density**	**Sink or float?**
Yellow				
Blue				
Green				
Red				
Purple				