Phys 115: Inquiry Into Physics	**2nd Assignment, due Monday Sept. 17th**
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Please bring only one copy of this HW to class. We will make additional copies so group mates can comment on the homeworks. You can decide amongst yourselves which two group mates to give your HW but each person should have no more or no less than two HWs to comment on. Please also email them to me at ayush.courses@gmail.com. I encourage you to draw figures to explain your ideas.

Well, I want you to think of the homework not as assessment exercises to test what you know, rather as means to reflect on the discussions in class, try and collect the different ideas generated, refine your thoughts, and maybe apply the ideas generated in class to a new situation that we did not specifically talk about etc.

1. Measuring the Volume of an apple

In class, one of the ideas that most interested you from the view of floating/sinking was that things that are less dense than water float in it. Maybe we had read it somewhere, or it kinds made sense, in some way. But since this is a science classroom we need to be precise. We needed to test the idea. Is an apple *really* less dense than water and the iron bar denser? Can we measure these densities? But before we do all this, we needed to come to a better understanding of what density is! So we started talking about what is density. We decided in class that density is how heavy something is in relation to its size and wrote down that density = weight/volume. (Now, I understand that we had quite a lot of discussion about mass and density, but for now, we could let us just use density in this way – especially since this question does not address the topic of mass vs. weight). And though we could measure the weight of an object simply by putting it on a scale, we had trouble finding the volume of objects like apple that were not rectangular or cubicle in shape. So what do we do? Most of you had noticed that when an apply floats in water, or the iron bar sinks, the level of water in the beaker goes up. In determining the density of the apply many of you used this water-displacement method. And on Wednesday this is what led to an amazing discussion.

Idea 1: Some folks wanted to use the volume of water displaced when the apple was floating as the volume of the apple.

Idea 2: Others wanted to push the apply just under the surface of the water, so that it is just completely under water and use that volume of water displaced as the volume of apple.

A. In this question, I want you to pick one of these two ideas that you think gives the correct volume of the apple. Explain your view in full details, with pictures if needed, and tell me why you think that your method gives the volume of the apple. It is not enough to say, "I think this is right". Give me the reasoning behind your 'feeling' something is right.

B. Now consider why someone would entertain the other idea. How is it that the other idea seemed more sensible to one of your classmates. What could have been their reasoning?

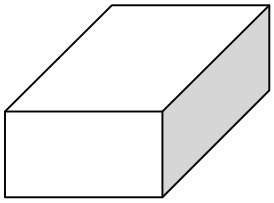
C. In the third part of this essay, respond to their reasoning. Once again, this is not about "my reasoning is right"; I want you to think about why their reasoning is inappropriate in this context. So respond specifically to the arguments you make in the part B of the question.

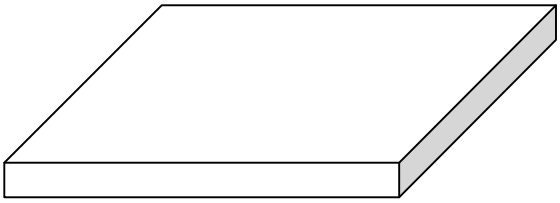
[It is also possible that you think that you do not want to choose either of these ideas. In that case, explain your own idea for measuring the apple's volume. For B, think about why someone would entertain Idea 1 or 2; and in C respond to their argument]

D. Now scientists often have such arguments, but they do not resolve arguments just by looking up a book (in most cases, there isn't a book!) but they do come to consensus and agreement. Sometimes it is by judging the reasonableness of an argument, and at other times by doing experiments. So in the final and fourth portion of Question 1, I want you to think about some possible way you could test which one of these two ideas works for measuring the volume of an object. It is okay if you cannot come up with a method after spending some time thinking about it. In that case, just let us know what your thoughts were.

2. Rolling out dough

In class, on Wednesday, we had a brief discussion on what would happen to the density if we pressed out the Al-square into a thin foil. Of course, we do not have the equipment to test that out. But I was thinking of a different situation. Think of dough. Consider a rectangular piece of dough (dough-A) that was flattened out into a thinner shape (it looks like dough-B after flattening out). Think about what happens to the density of the dough in this process.





Dough-A dough-B

Is the density of the dough-B same as that of dough-A?

A. Present your argument in full details. If you need to explain how you understand density, do feel free to tell that.
B. Remember the pictures that we were drawing on the board with dots when we were talking about density. So if you were in the magic school bus and could look at the particles of dough spread out in the two cases, how would they be? Draw pictures of the dough particles in the case of dough-A and dough-B. Take care: think about it, does your picture reflect your answer about the density of dough-A and dough-B?
C. Tell me why someone else might pick the answer that you did not choose. What could their reasoning be? This is ***not*** a response to you, just their reasoning of why they would choose the other answer. Also, draw pictures for their idea: if they were to represent their idea of dough-A and dough-B drawing dough particles inside, how would they have drawn the pictures?