

Phys 115: Inquiry Into Physics	2nd Assignment, due Monday Sept. 24th
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1. Please bring one copy of this HW to class.
2. Please also email them to me at ayush.courses@gmail.com.
3. **For revisions of HW 3, please italicize all changes so that I can follow easily.**

1. **Weight and Volume**

In class on Wednesday we were talking about mass and volume. We had decided that weight is more meaningful in our class, but somehow we did refer to mass. Really by mass what most of us meant was how heavy something was. Once again, in the context of this problem it really does not matter whether we talk about mass or weight but just be consistent in your essay.

While talking about the experiment of group 4 (cutting up the dough, lime etc into a piece) we said that **mass (or weight) and volume are "proportional"**.

Later we were talking about the experiment on wooden block attached to the Aluminum block; the conversation veered into talking about forcing the apple so that it is completely submerged. And then a few people said something like **mass (or weight) has nothing to do with volume.**

Tell me your thoughts on this: Does weight have something to do with volume or not? Be very clear about your reasoning. Specifically give an example of a situation that supports your reasoning. Also think of a situation where your reasoning does not work. Tell me how the two situations are different. (So for example if you decide that they are not related then tell me why you think so; give an example to explain your reasoning; then give me an example where they might be related and explain why that case is different)

2. **Looking back on list of ideas**

In class a couple of weeks ago you did whiteboard presentations on the different ideas for what makes something float. We collected a long list of all the different ideas. Look back into class notes and go over that list.

In the light of all the discussions and experiments we have had since then, maybe an idea no longer holds or needs a “serious modification”. Choose such an idea and tell me:

a. What observation (or result) seemed to support that idea at that time and how? In other words, why did we entertain that idea at that time.

b. Explain the reasoning behind not finding that idea valid anymore. (Maybe there are other observations that argue against the validity of that idea; or maybe the idea itself has some flaw. Tell me about these other observations or explain the specific flaw in that idea. If you do not want to completely reject that idea but just modify it, then tell me how you would modify that idea.

c. Now, if we reject that idea, then somehow we need to explain the observation in part a, using the remaining ideas. Discuss very specifically how do you explain that particular observation now. If you decided not to reject that idea but modify it, then specify how the modification changes our understanding of that observation.

3. The incredible meaningful-ness of units

Physicists love to use units to help them understand and explain ideas. That’s what I want you to do in this problem: think about how the units of density tell us about what density means.

In class we have been using writing density of objects with the units “grams per milliliter” (abbreviated g/ml). It turned out that we could also use “grams per cubic centimeter” (and some people do, and they abbreviate it g/cm^3 or g/cc) because a cubic centimeter and a milliliter are exactly the same volume. One cubic centimeter is the volume of a cube on which every edge is one centimeter long, about the size of small dice. A gram (g) is a unit of mass, which is an amount of matter. One gram isn’t very much matter; a small paperclip has a mass of about one gram, so that gives you a sense of how much weight is in one gram.

In this problem we want you to pretend you’re a physicist and explain how the unit tells you what the idea density means. What can we tell about the meaning of the concept density from knowing that the unit of density is g/cm^3 ? It might help to think of this as answering the question what does g/cm^3 mean? And its meaning should also tell us what the concept of density means.