Phys 115: Inquiry Into Physics	**HW 5: Due Monday, October 1, 2007**
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Comments on Revision of HW 4

Here are a few comments to consider when revising HW 4
Mass and Volume: I had asked if mass and volume were related. I want to clarify what I meant by that. Of course, we do understand that volume and mass refer to two different things – the size and the amount of matter (we can roughly tell how much matter there is by weighing the object). By related, I wanted you to consider if changing one would necessarily change the other. In other words, think of a situation such that if you take an object of larger volume that means that its mass also must be greater than the one with smaller volume. Think of another situation when this does not hold. As you revise, just see that it is this sense that is being captured in your answer

Questions on Units: Think about it: if you were buying yogurt at a store and the tag there said, '50c per oz." you would say aha! I have to pay 50 c for every ounce of yogurt I buy. So 50 cents is how much every ounce of yogurt costs. I wanted you to consider that kind of interpretation of units in this question. Consider something that has the density of 5 g/cm^3. What does that number 5 mean in this case? Yes, it's the density; but what does it mean that it is the density? If another object has a density of 2 g/cm^3, why is the number 5 for one object and 2 for another – don't just say that they have different density – explain using the interpretation of the number 5, how the numbers are different for the two objects.

Fresh HW 5

Question 1: The apple bobs up
We saw in class that the wood block floats in water. And if you push it into the water, it comes out again if you let it go. Here, speculate on what you think might be going on. Why is it that the wood block moves up when you let it go? One suggestion made in class was that the block "wants to" come back to its natural position in water. Now a wood block is not like a person who wants to go anywhere and so there much be something, some mechanism that is behind that intuition of 'wanting'. And also, don't just say, "it's water". Water was there when the block

was simply floating – so what changed? Its okay to speculate here, but I want you reason about why the block moves up when released from under the water.

Question 2: **How can alcohol possibly be less dense than water?**

In class one of the groups measured the density of the blue liquid and found that it was less dense than water. I think they found the density of the blue liquid to be .763g/ml. Now, I happen to know what that liquid is (well, I am the instructor ☺). The blue liquid was isopropyl alcohol and its chemical formula is C_3H_8O, that's three carbon atoms, eight hydrogen atoms, and one oxygen atom. Recall that water (H_2O) molecules are two hydrogen atoms and an oxygen atom. Don't worry about this; the main point is that an alcohol molecule is much larger than a water molecule. [The mass of a molecule is commonly given in "atomic mass units" (AMU). A water molecule has a mass of 18.0 AMU and an isopropyl alcohol atom has a mass of 60.1 AMU. Don't worry about AMU – think of it as another unit for mass just like we said that we could measure volume in cm^3 or ml or liters]. And yet water is more dense than alcohol. How can this be? Given what we understand about density, and the observation that the molecules of alcohol are a lot more massive than water molecules, how might we reconcile this apparent contradiction? Tell me very specifically how you would explain that a liquid with heavier molecules is less dense.