Phys 115: Inquiry Into Physics	Eleventh Assignment, due Monday, Nov. 26th
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Question 1:

In class today we talked quite a bit about the homework question on what makes the hot water molecules slow down, as the water cools. We were talking about a cup of hot water that was left out on the table. Here is how one student argues about it:

Lucy: Well, I think that the energy from the hot water goes into the air. The hot water molecules and the cold air molecules bump into each other at the water surface; the water molecules slow down and lose energy; the air molecules speed up, and gain energy. The energy lost by the hot water is exactly the energy gained by air. That's all there is to it really – much like the hot and cold water story when we mixed hot and cold water.

A> What do you think of Lucy argument. Does it adequately explain how the hot water molecules slow down or are there flaws in her argument that you notice or questions that her argument raises.

B> Can you use Lucy's argument to explain how a hot pan cools down (The idea was that a hot pan if left on the table cools down gradually; we were talking in class about how can we see that happening from a molecular picture)?

C> Now consider another student Susan to respond to Lucy

Susan: Hmm, I like the molecular picture and that the energy for hot water goes into the air. But what about this then: we had said the temperature is a measure of heat, then how come the temperature of the hot water falls down a lot, while the temperature of air in the room does not change much at all (maybe slightly, but not much). The idea that the air gained exactly the same amount of energy as the hot

water lost does not make sense completely since the change in temperature of water and air are so different.

Does Susan's argument make sense to you? Write a paragraph or so on what you understand her argument to be.

D> Is there some way you can resolve Susan's confusion. It's perfectly okay to speculate an answer here. It's also okay to say that you don't have a good response right now.

Question 2: Mess of Numbers

In class on Wednesday, we were trying to make sense of the data for mixing unequal amounts of hot and cold water. There were two main ways that groups came up with to predict the final temperature when mixing unequal amounts of hot and cold water. Here let M-hot and M-cold be the amounts of hot and cold water and T-hot and T-cold be their temperatures; Also T-final is the temperature of the mixture of hot and cold waters.

Here are the two equations:

1. Parts of whole method (also the feather of turkey method)
   IF M-hot > M-cold, then T-final = (T_hot x N + T_cold) / (N + 1) where N=M_hot/M_cold
   If M-hot < M-cold, then T-final = (T_hot + T_cold x N) / (N + 1) where N=M_cold/M_hot
   (Notice that N depends on whether we take more of hot or more of cold water and also the position of N in the formula changes in the two cases)
2. T-final = (M_hot x T_hot + M_cold x T_cold)/(M_hot + M_cold)

If you were in class you should have these in your notes. The recap is mainly for those who were absent. [Email me if the way I wrote down the formula confuses you]

Now I want you to pick out any two sets of data for the unequal amounts of hot and cold-water experiment (we had five sets of data from the five groups). [If you missed class today, then you

would need to contact a group member to access the data sets – in the worst case, email me and I will send you the numbers]

A. For each set of data, calculate the final temperature using method 1 and then method 2. Please show the steps you are following. It is important that I understand what you are doing – what are the different quantities etc. It should be a comprehensible mess of numbers, not an incomprehensible mess of numbers.

B. For each set of data, how does the final temperature calculated using method 1 compare to the final temperature calculated using method 2. Are they same or different? What does this tell you about the two methods? (Maybe it tells you nothing, and maybe it does)

Question 3: Two students Bert and Ernie are having a conversation:

Bert: When you turn on a gas stove, it lights a flame and that flame and the air right around it has a lot of heat energy. That heat energy gets transferred to the pot that you set on top of it. As the pot gets more energy, it starts to transfer some of the heat energy to the water inside it. As time goes on, the flame transfers more and more heat to the pot, and it, in turn, transfers the heat to the water inside it. This means that the water gets hotter and hotter, until it has so much energy that it starts to boil.

Ernie: If you put a pot of water on top of the gas flame on a stove, then the flame has molecules in it that are moving around really fast. The flame molecules bump into some of the molecules in the pot, which makes them move faster. The flame molecules continue to hit the pot molecules, making more and more of them move faster. Since they are moving faster, they bump into the water molecules in the pot, making them move. These faster water molecules bump into other water molecules, causing them to move more, until they are moving really fast and some move so fast that they turn into gas molecules, and escape, which is when the water is boiling.

Write an essay on your thoughts on the following points:
Are both Bert and Ernie talking about the same thing?
Do you think that there is any difference in the nature of explanations offered by Bert and Ernie? If so, how would you say are they different?
Is one more productive than the other, or are their explanations good for different purposes?