

HW 7 Due Wednesday, March 28th

1. **Conservation of Energy**

Typically in this class, we talk about your ideas, rather than providing you with ready-made explanations, as you are perhaps more used to from other science classes. Our motivation for this is that we want you to use ideas sensibly rather than just memorizing them. In this question, I will depart a little bit. In class we talked a little bit about conservation of energy. This means something very specific to physicists. They usually speak of conservation of energy as such: If I do not add or take away energy from a system, then the total energy of the system remains constant.

Now I want you to use this idea to make sense of what might be going on with energy when we mix a cup of hot water with a cup of cold water and let them come to a common temperature. I am not looking for a 'correct answer', but if you can use an idea sensibly, or if this idea works for you. If this idea does not make sense to you or is not helpful to you in understanding what might be going on, explain how it does not make sense. Maybe there are things that this idea does not explain and that could be bothering you or it could be something else. In any case, we are looking to see if you can express your ideas clearly and sensibly. Also, please explain what you are thinking of when you say energy. If needed draw a picture. Do not assume that I will understand what image you have in your mind.

2. **Potential Energy**

We talked a little bit in class about potential energy. I want you to clearly articulate how you think of potential energy. Once again its about your view not a "physics-y" view.

Did potential energy play a role in your explanation in Question 1? If so, what was that role? If not, why do you think potential energy did not play a role in your explanation?

3. **Formula for final temperature:**

In class, we came up with a couple of formulae for the final temperature (when water at two different temperatures are mixed). One was $T_{\text{final}} = (x*a + y*b)/(x+y)$ where x and y are the amounts of the water and a and b are their temperatures. The other formula was $T_{\text{final}} = (mT1 + nT2)/(m+n)$ where the amounts of water are in the ratio $W1:W2 = m:n$ and their temperatures are $T1$ and $T2$.

Now often, we get this complicated mathematical expression that provides us the right answer but we do not know how it works. In this question, I want you to try and make sense of any one of these formulae. Pick one, and think about it. How does it make sense to you? Can you understand in words what the formula means to say?

Now the formula does seem to make the right prediction. And that is good, but I am not looking for just that reasoning. I want you to think how you can understand the formula from a physical perspective. I am looking for your own thinking, not re-iterating something said in class (unless that is something that you really understand).

4. **Copper in hot water (problem)**

You have 100g of copper sitting in a pot of hot water. You take it out and place it in a cup with 50g of water at 22 degrees Celsius. Later, you measure the temperature of the water in the cup to be 30 degrees Celsius (This is after the the copper heats the water and the temperature stops rising, but before the water starts cooling down to room temperature). What was the temperature of the hot water in the pot?

Feel free to ask questions in class if some part of the HW is not clear, or if you are unsure of what the question is asking.