

Lecture S2 Muddiest Points

General Comments

There's still considerable confusion about the sign conventions we are using. Bear with me — I hope it will make sense as we proceed.

Responses to Muddiest-Part-of-the-Lecture Cards

(44 cards)

1. *General confusion about sign conventions, including the sign convention concept test. (11 students)* Many students are still confused by sign conventions. Many of the questions were non-specific. A couple of folks thought I could have spent more time on the concept test, and they're probably right.

I will repeat the arguments I made in class, and in the last muddy card responses. The first comment is the sign convention is, well, a convention, which means that we all label things the same way because we agree to label things the same way. The second point is that the convention is useful because it is consistent, although it may not appear to be so yet. By always using the passive sign convention, we can always tell which elements absorb or dissipate power, and which supply power.
2. *On one example, you label the current going through the element, and in another, you label the current going out of the element. Which is it? [The picture shows one case where the current is drawn right next to the element, and another picture shows the current flowing through the wire coming out of the element.] (1)* Both. The current flowing through the element is exactly the same as the current flowing out of the element through one lead, or terminal, of the element.
3. *You confused a lot of people by saying that the current inside a voltage source goes the "other way" from plus to minus inside. (1)* Actually, I was asked if the current flows the other way inside the battery, and I said that it doesn't. What I said (I thought) is that in the inside of the battery, there may be a flow of positively charged ions in the opposite direction. But this is current flow in the same direction.
4. *Unclear on the relationship between Kirchhoff's Voltage Law and Kirchhoff's Current Law. (1)* There really isn't one — they are independent results, which follow from two different conservation laws, conservation of energy, and conservation of charge. They are applied together to solve circuits.
5. *How to use matrices to solve large systems of equations? (1)* Please read the primer on linear equations. Matrices greatly organize systems of linear equations, and reduce the effort required the equations, so please read and understand this material.
6. *Going from + to -, can you still apply this in a loop, or just across an element? I think in a loop, both directions can be said to flow from high to low. (1)* I'm

confused about the meaning of your question, but current doesn't always flow from high to low! It usually flows from low to high across a battery.

7. ***How does a capacitor complete a circuit if no current flows through it? (1)*** It is true that no current flows in the space between the capacitor plates. However, the close proximity of the capacitor plates (and perhaps the presence of a dielectric) makes it possible to store charge on the plates. So current flows into one plate, and current flows out of the other plate, even though there is no flow between the plates. From the perspective of the outside observer, it looks as though current flows through the capacitor, and this is the easiest way to think about it.
8. ***Does it really matter which way you label the directions as long as it comes out in the end? (1)*** Yes and no. No, it usually doesn't matter which end of a resistor is +, and which is -. Yes, it does matter that you label the corresponding current consistently, using the passive sign convention.
9. ***The direction of the current flow is a bit confusing. Why shouldn't the current flow in the same direction in one big loop? (1)*** In a simple example (the 2 element circuit), we do know *a priori* that the current in all the elements is the same, if we label the currents properly around the loop. But most circuits aren't single loops, and it's not possible to guess in advance which way the currents will flow.
10. ***I'm rusty on Kirchhoff's laws. It would have been nice to review those more, but I think I understand now. (1)*** I can see how some review would have helped. I'm also getting complaints about going too slow, so I'll balance as well as I can.
11. ***Does Kirchhoff's Voltage Law depend on which direction you choose the i_n ? (1)*** Yes, sort of. When you apply KVL around a loop, you have to sum the voltage drops around the loop. How that sum is made up depends on how the v_n are labelled around the loop. The i_n follow from the v_n (or vice versa).
12. ***I don't understand why we can't use the labelling we used in 8.02. (1)*** The point is that we will be doing circuits much more complicated than in 8.02. In 8.02, you often worked with single-loop systems, so you could label every element with the same current. That won't happen with more complicated circuits.
13. ***How does the sign convention work for a current source? (1)*** Just like for every other element! The current should be labelled in the same direction as the source itself, and the plus/minus signs should be placed so that the current is flowing from + to - through the source. It will often turn out that this leads to a negative voltage, but that's OK — it's consistent with the passive sign convention.
14. ***No mud (including 8 who turned in a definition of "model," but did not mention mud. (20)*** Good!