

Circuit Construction Kit Lesson Plans

A series of three labs, several days of class

Learning Goals: Students will be able to

1. Discuss basic electricity relationships $V=IR$, *equations for series and parallel circuits*
2. Analyze the differences between real circuits and the simulated ones
3. Build circuits from schematic drawings
4. Use a multimeter to take readings in circuits.
5. Provide reasoning to explain the measurements in circuits.

Background: We will have studied static electricity and talked about a general model of current. We talk about electrons flowing from high PE to lower PE like water falling off a cliff. We do have a discussion that this is just a simple model to help us make sense of the relationships. I often use the analogy of students running a cross-country race with using all the energy of one energy bar. Hill height, body mass, speed are some things that they will see effect the outcome. The three labs are guided to prepare the students for the text readings and subsequent calculations.

Circuit Construction Introduction:

I demonstrate how to use a multimeter (or traditional meters for regular physics). I show a battery being measured and hold up a real resistor. I also talk about how a light bulb works a little so we can refer to resistors like light bulbs throughout the series. I did not provide any demonstration of the sim. I have tried using both the versions of the DC CCK and have not noticed a difference in learning for my students. If my students ask questions that I think the virtual ammeter will provide more insight, then I have them open the virtual version and investigate.

Some basic skills for using the sim, you might want to review:

1. Adding parts
2. Connecting parts with wires
3. Deleting wires or parts to add parts. You can't just add after the circuit is built.
4. Using the voltmeter and ammeter. The non-contact ammeter is especially handy, but the other one is realistic.
5. The difference between schematic and lifelike views. In all my student directions, I plan to use schematics.
6. Clearing the image to start something else.
7. Using high voltage on may cause the system to freeze.

Lesson: I have written a series of three labs for circuits. The first two have skills using both real equipment and the simulation for the honors classes. There are also versions that mostly use the sim that the regular physics teacher used. The last lab is meant to be done with real equipment using CCK to check their circuits. Also, I wrote a version of the third lab for use with the sim only.

Before the second lab, we will have a class discussion about resistance using the illustrations on our text and analogies. One analogy that I use: the students pretend they are trying to get to the office from a classroom. We talk about how hall size, distance to the office, congestion,

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size of students in the hall and whether or not they are moving effects the time and energy it takes to get there.