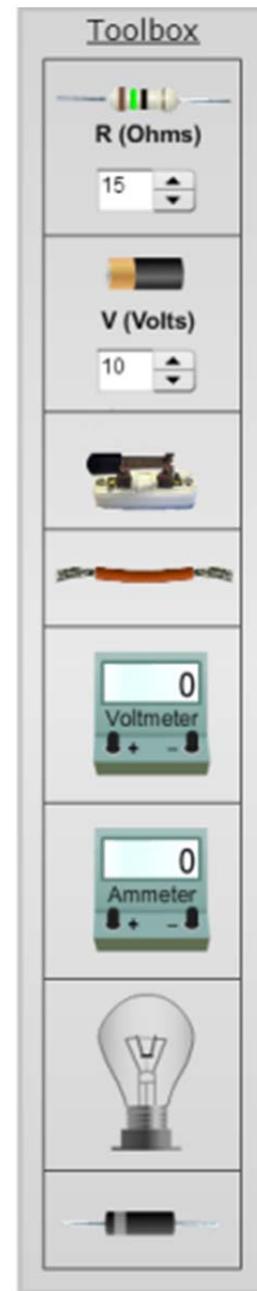


**The Toolbox.** All of the circuit elements begin in the Toolbox. From top to bottom, there are resistors, batteries, switches, wires, voltmeters, ammeters, light bulbs, and diodes. Click and drag any element from the Toolbox and drop it on the circuit area, which is the big blue rectangle to the left. The resistor and battery can be adjusted before adding them to the circuit by using the stepper below each in the Toolbox. These can also be adjusted later as described below.

**The Circuit Elements.** Once on the circuit area, the circuit elements can be modified in a few different ways. First, they can be shifted by clicking and dragging on the center of the element. Or just the ends can be moved by clicking and dragging on either the green or blue dots on the element’s sides. For most elements, like the resistor or battery, this will rotate them around the opposite dot. For other elements, like the meters, this will only move the terminal ends of the wire coming from that element. To rotate an element that’s part of a circuit, other elements may have to be moved out of the way first. An element can be removed by clicking and dragging it to the “Recycle” bin.

- *Battery* – Right clicking on a battery will give an option to “Reverse Battery,” which flips the polarity of that specific element. Handy when dealing with diodes.
- *Resistor* – Notice that the color bands on the resistors change as the resistance is increased or decreased.
- *Switch* – Double-click on the center of a switch to open or close it.
- *Meters* – The voltmeter and ammeter have a special control to allow for ease of use. By holding the Shift key while clicking and dragging the center of the meter, the meter itself can be moved while keeping the terminal ends in place.



**The Selected Element.** When an element is clicked, it will glow blue and become the “Selected Element.” In the box directly below the circuit area, the type of element that is selected will be shown, and any available options will be displayed. For most elements, the only option is to “Remove Element” from the circuit by clicking a button. For the battery or resistor, the voltage or resistance can be changed in this box.



**Clear All.** To completely clear all elements from the circuit area, just click this button found in the bottom left of the screen.

**Values.** The values of any and all batteries or resistors in the circuit area can be displayed or turned off using the “Values” check box in the bottom left of the screen.

**Schematic.** Similarly, the circuit area can show real elements or schematic versions by using the checkbox labeled “Schematic” in the bottom left of the screen.



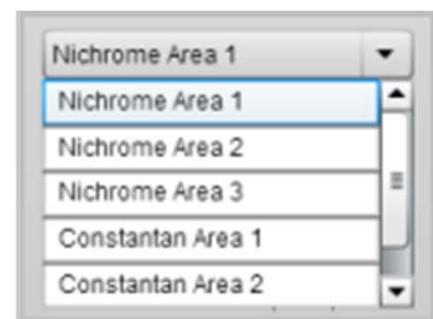
**Recycle Bin.** Drag any unwanted circuit elements to the Recycle Bin to magically shuffle them back into the Toolbox.



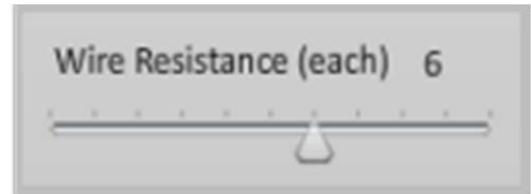
**Pre-made Circuits.** Directly below the Recycle Bin is a drop-down menu labeled “Pick a Circuit.” Click the arrow on the right and scroll through this list to pick from a variety of pre-made circuits. Some circuits are called “Double” which will display two of the same circuit, allowing modification of one to compare to the other. Caution: Selecting a pre-made circuit will remove everything else in the circuit area. To clear a pre-made circuit, click the “Clear All” button or select a different pre-made circuit.



**Resistivity Challenge.** This drop-down menu to the right of the “Pick a Circuit” one, is used to show circuits used in testing the resistivity of different cross-sectional areas of a wire. There are three different cross-sectional areas of Nichrome wire or of Constantan wire to choose from. Note: Just like with the pre-made circuits, selecting any of these Resistivity options will replace everything else in the circuit area.



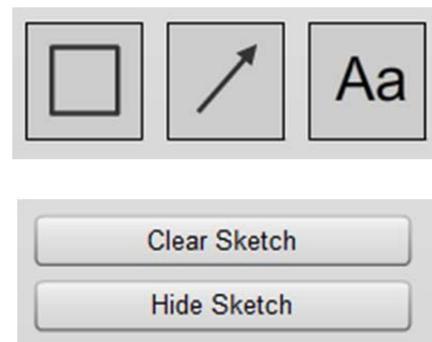
**Wire Resistance.** Most of the wires used in this lab are “normal wires,” aka any wire that’s not the Nichrome or Constantan variety. To change the relative resistance of a normal wire, click and drag on the arrow under “Wire Resistance.” By default the wires have a resistance of zero.



**Ruler.** A standard ruler can be used in this lab as needed. This can be displayed by clicking the “Ruler” checkbox near the bottom of the screen. Move the ruler by clicking and dragging on the 5cm end, or rotate it by clicking and dragging on the 40cm end.



**Sketch.** There are tools that can be used to sketch, mark, and label items in your circuits as you create them. Boxes, arrows, and labels can be clicked and dragged onto the circuit board at any time. The arrows can be adjusted by clicking on the arrowheads or the body, and the boxes are adjusted by clicking on the circles in the middle and in the corners of each box. The labels work similarly, clicking and dragging on the circle will move the label, and clicking into the label will allow you to type.



Items can be removed one by one by moving to the recycle bin, or the entire screen can be cleared of sketch elements by clicking the Clear Sketch button. Hide Sketch will make any elements invisible until you click Show Sketch again.

**Snapshot.** As with most of our labs, you can take a screenshot of any portion of the screen by clicking on the Snapshot icon and then clicking and dragging a box around what you want to capture. A dialog will then appear asking you what you want to call the image and where you want to save it. In most labs, a timestamp will be added to the image to keep track of it better.

