# ECE112 - Lab 1

## Purpose

- Become proficient with soldering
- Part identification
- Translation of schematic diagram to physical implantation
- Measuring voltage and current with a DMM

## Parts/tools needed:

- Big pad protoboard
- Wire for making connections
- 2, 1K ohm resistors
- 1, 4.7K ohm resistor
- 2 red LEDs
- AA Battery pack (3 cell) with batteries
- Soldering iron, tip and solder
- Diagonal Cutters and Pliers
- Digital Multimeter (DMM)

## Building the Circuit

Build the circuit shown in figure 1 on the protoboard. It may be helpful to think of each circuit node (A, B, C, D) as an individual pad on the protoboard. However, if too many wires are going to one pad, simply connect that pad to an adjacent one to make the additional connections. Leave out one battery until we are ready to make measurements.

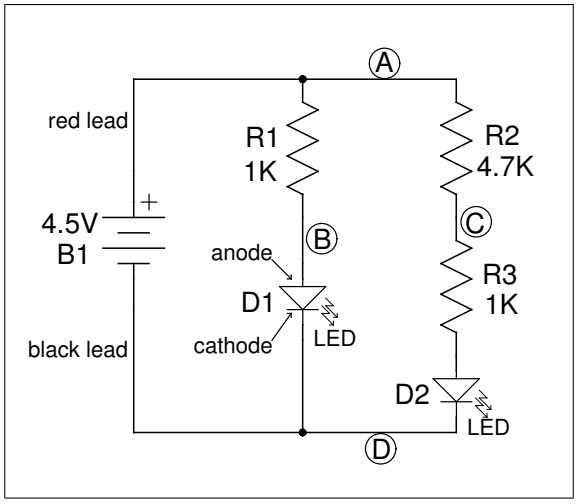


Figure 1: Lab 1 schematic

When wiring the LEDs, note that they have polarity that must be observed. The end with the arrow is called the *anode* (positive terminal) and the other end is the *cathode*. Current flows from the anode (+) towards the cathode. The anode terminal is determined by finding the longer of the two leads. See figure 2. Your LEDs may be clear or red in color.

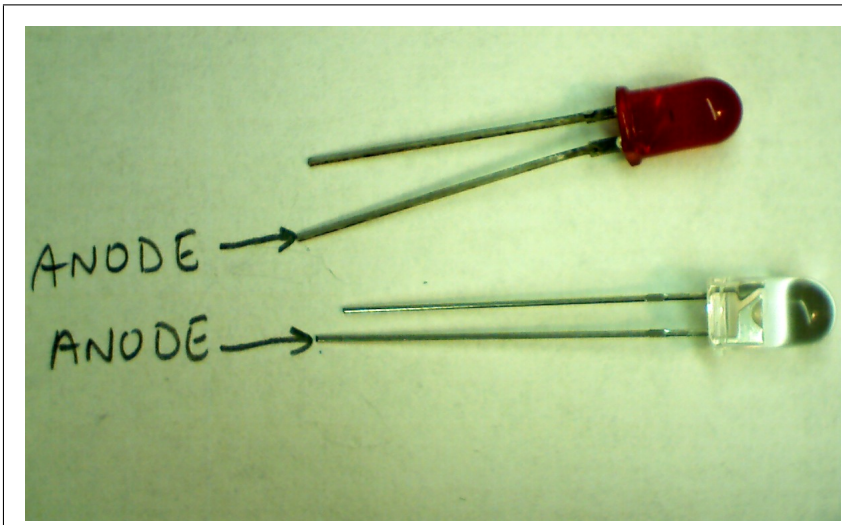


Figure 2: The anode (+) lead of the LED is the longer one

In figure 3 we see the protoboard wired as the schematic indicated. The components are not physically oriented as the schematic might indicate, but that does not matter as long as the connections are electrically the same. Note the use of bare *bus wire* to make connections between pads.

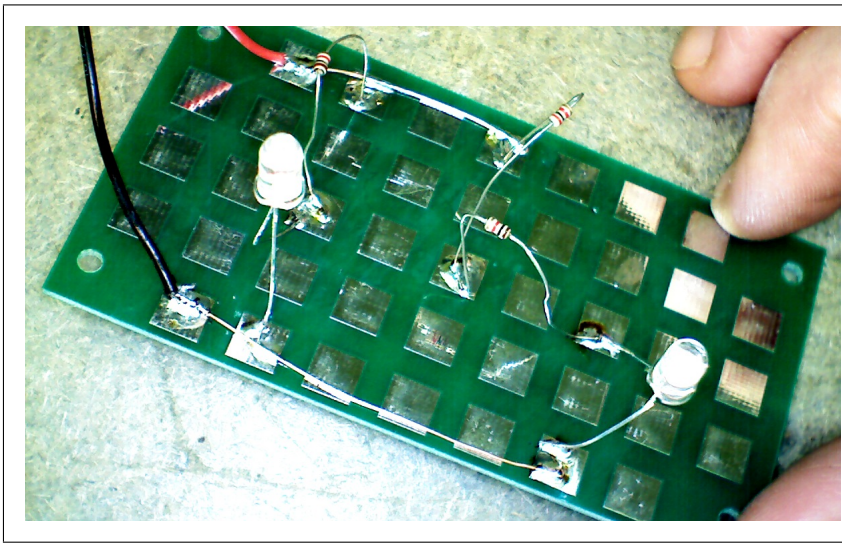

Figure 3: Wiring for lab 1 completed

## Making Voltage and Current Measurements

Sometimes while making a measurement, you will run short on hands to hold the DMM probes. One solution is to make a *probe helper* from a bit of bare wire wrapped around one probe tip. Solder the wire to one of the points you are taking a measurement from. Don't solder the wire to the probe. If you wrap the wire around the tip firmly, it will hold. In fact, once its soldered in, you can slip the tip out and reuse the probe helper. This will free up one hand for other tasks. See figure 4. Alternatively, you can use the hook probes that are included with your DMM instead of the pointed probes.

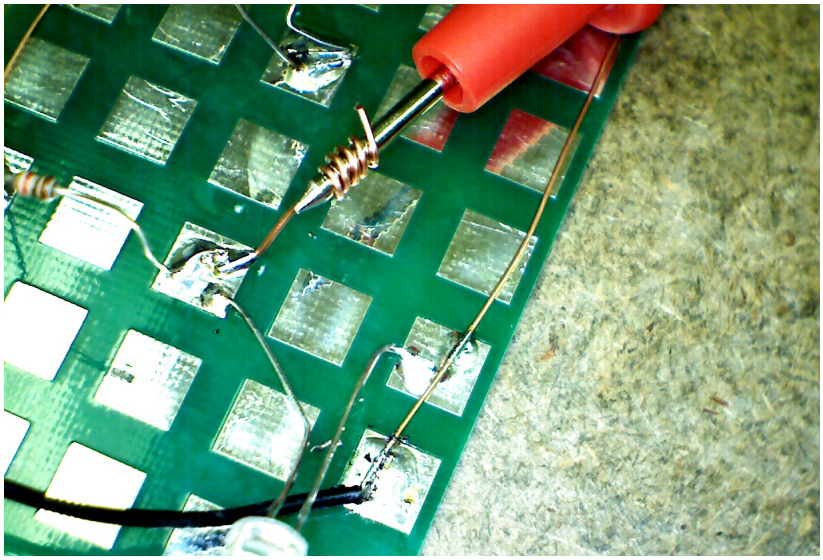

Figure 4: A Probe Helper

1. Put all the batteries into the holder. Both LEDs should illuminate. If not, you have made a mistake. Fix it before proceeding. Then, put the DMM in voltage measuring mode. Record the following measurements:

a. Battery pack voltage: _____

b. Voltage across LED D1: (red lead to anode) _____

2. With the DMM out of the circuit, place it into current measuring mode (20m scale). Make and record the following measurements:

a. The current through the 4.7K resistor. This is found by opening the circuit at node C and placing the DMM into the circuit at that point. In other words, unsolder R2 and R3 and put the DMM between them. The DMM "+" probe connects to the bottom of R2. The DMM "-" probe connects to the top of R3.

Current through 4.7K resistor: _____

b. Remove one battery to disable the circuit. Keeping the DMM probes in the same location, change the meter setting to measure voltage and put the battery back in.

Does LED D2 still illuminate? _____

Why? _____

3. After disabling the circuit again, restore the circuit to its original configuration with R2 connected to R3. Both LEDs should be illuminated. With the DMM in current measuring mode, place the meter probes across the 4.7K resistor.

What happens to the brightness of the LED D2? _____

Why? _____

4. Have your TA check off your work.

5. Afterwards, unsolder all the components from the board and store them for reuse. Don't try to clean any excess solder off the board. It's helpful in later use if some solder remains on the pads. Also, pull one battery out of the battery holder to prevent damage to the batteries from them shorting out.