General Physics Lab 0

Introduction to Electronics Tools

Objectives:

- Learn how to use a multimeter
- Learn how to use a breadboard
- Learn how to build a circuit
- Learn how to read circuit diagrams

Equipment:

- Multimeter with Probes
- Breadboard
- Jumper Wire Kit
- 2 Alligator Clip Wires
- 9V Battery
- 9V Battery Connector
- 1000 µF Capacitor
- 470 Ω Resistor (yellow, violet, brown, gold)
- 5.1 kΩ Resistor (green, brown, red, gold)
- 1 kΩ Potentiometer
- LEDs

Procedure:

Pull out all the equipment you will need ahead of time and follow along on the Writeup and eJournal as you watch the video. Answer the questions, build the circuits, and take pictures as requested as you go through the video. All the answers can be found in the video so if you fill out the eJournal as you watch (pausing as necessary), you'll be finished by the end of the video. Ask for help if you have trouble. We want you to be able to finish so don't spend long struggling on it. If you need help, just ask.

Part 1 – Intro to Circuits:

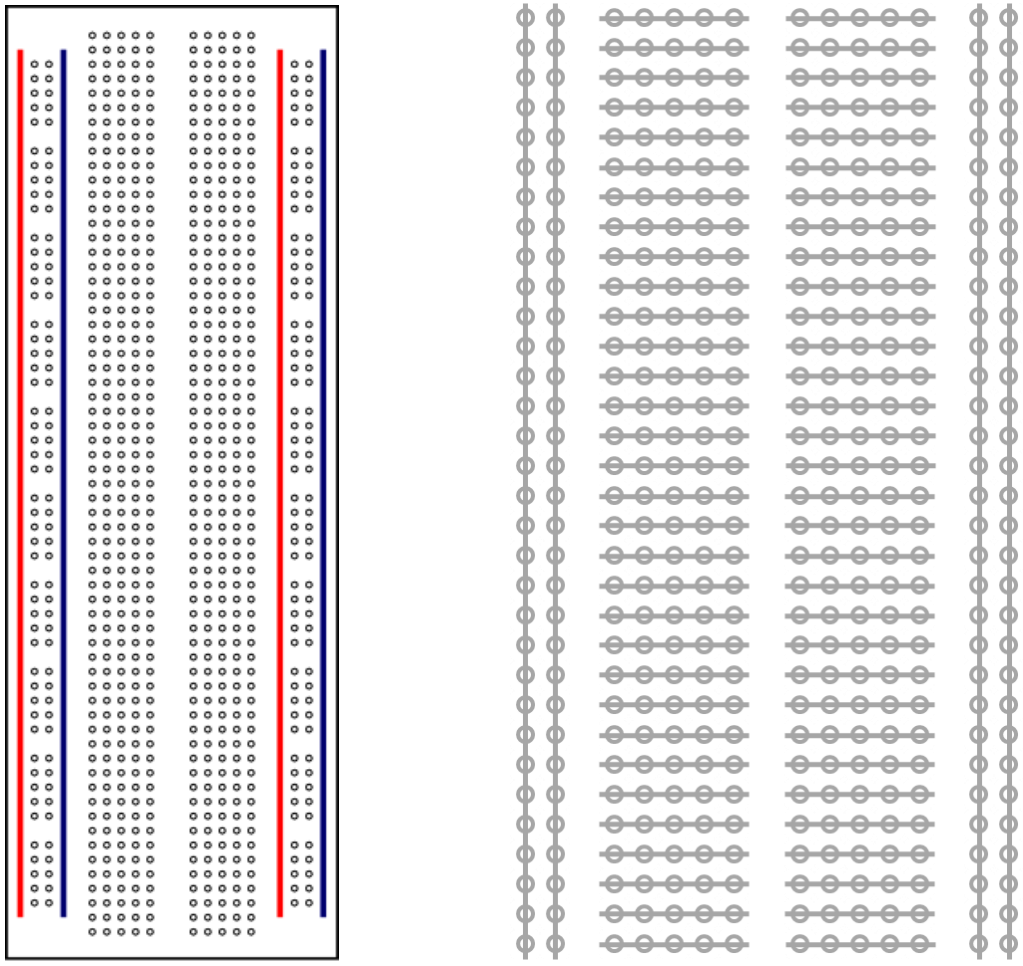
Watch this section in the video and answer the question in your **eJournal**.

Part 2 – Multimeter:

Watch this section in the video and answer the questions in your **eJournal**. The questions for this part are hypothetical. You do not need to measure anything for this part.

Part 3 – Breadboard:

Watch this section in the video and answer the question in your **eJournal**. It may help to refer to the following illustration (see Fig. 1).



(a) (b)

Fig. 1: (a) Breadboard top-view (b) Internal breadboard wiring

Part 4 – Battery:

Just watch this section in the video. Most everyone is familiar with using batteries so no questions for this part.

Part 5 – Capacitor:

Watch this section in the video and answer the question in your **eJournal**.

Part 6 – Resistor:

Watch this section in the video, follow the instructions, and answer the questions in your **eJournal**.

Look through the resistors in your lab kit to find the 470 Ω (yellow, violet, brown, gold) and 5.1 kΩ (green, brown, red, gold) resistors. If you want to know the values of the other resistors, you can look up the code in a resistor code table or use an online calculator such as the following link: https://resistorcolorcodecalc.com/. Hint: If the color code does not work or yields an unexpected value, try the colors in the reverse order.

Fig. 2: Resistor with Color Code Bands

When measuring with the multimeter probes on the breadboard, press the metal probe tips against the resistor leads (or other leads/wires).

Note: The probes **will not** fit down in the holes. Instead, the tips will touch the wire/lead and rest in the recessed region around the hole (see Fig. 3). You **must** touch the probe tip against the metal wire/lead when making a measurement. Simply touching the plastic will do nothing.

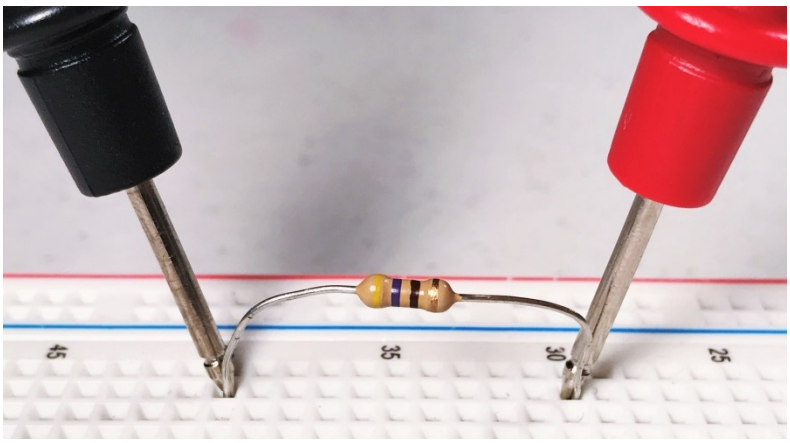
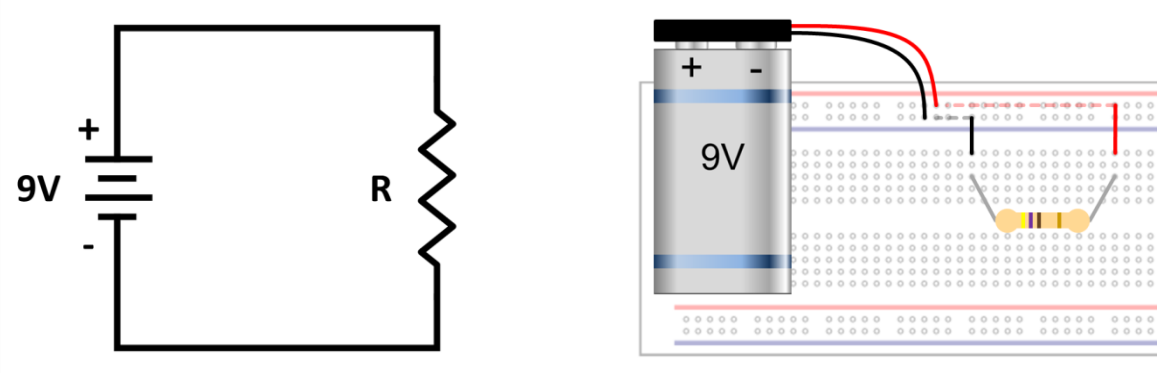


Fig. 3: Measuring a resistor with multimeter probes on the breadboard

Follow along with the video to build the resistor circuits on your breadboard. Insert a picture of the two-resistor series circuit (voltage divider circuit) in your **eJournal**. Provided below are some extra diagrams to help you with building the circuits.

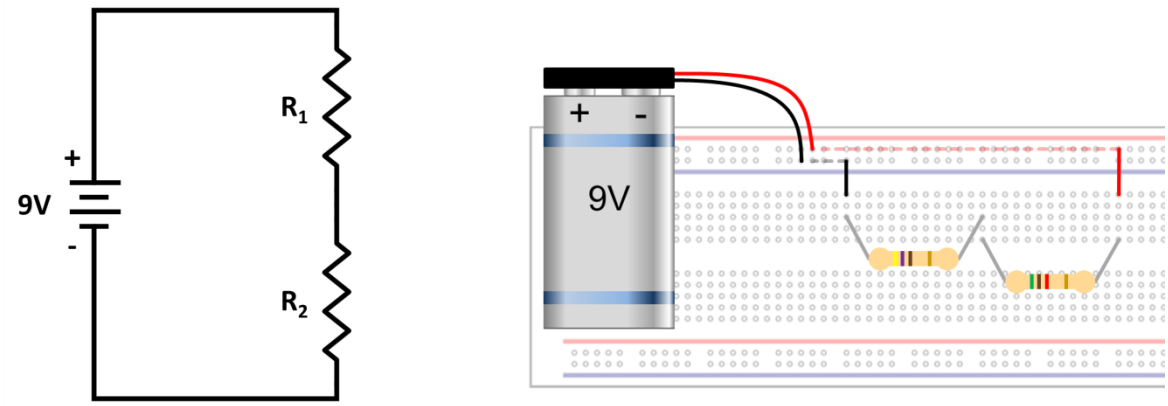
WARNING: Do not leave the single resistor circuit (Fig. 4) powered on too long or the 470 Ω resistor may get hot. Unplug the battery when not using it.

When you finish this step, remove the battery from the circuit and turn off the multimeter to save the batteries for future experiments and to extend the life of the circuit components.



(a) (b)

Fig. 4: Single Resistor Circuit with 470 Ω resistor
(a) Circuit Diagram, (b) Suggested Breadboard Wiring Diagram



(a) (b)

Fig. 5: Double Resistor Circuit (Voltage Divider) with R_1 = 470 Ω and R_2 = 5.1 kΩ
(a) Circuit Diagram, (b) Suggested Breadboard Wiring Diagram

Part 7 – Potentiometer:

Watch this section in the video and answer the question in your **eJournal**.

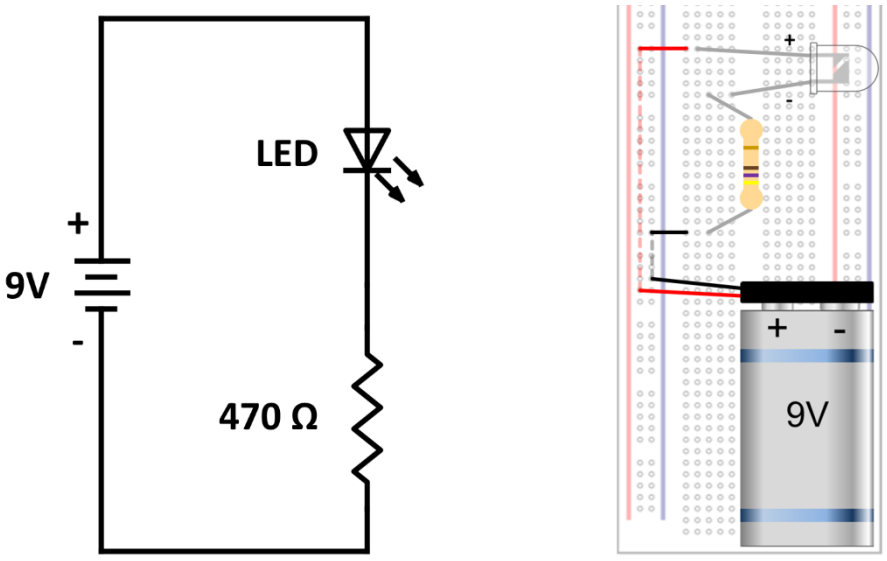
When you finish this step, remove the battery from the circuit and turn off the multimeter to save the batteries for future experiments and to extend the life of the circuit components.

Part 8 – LED:

Watch this section in the video and answer the questions in your **eJournal**. Insert a picture of the simple LED circuit in your **eJournal**. The following pictures and diagrams will help you with these steps.

When you finish this step, remove the battery from the circuit and turn off the multimeter to save the batteries for future experiments and to extend the life of the circuit components.

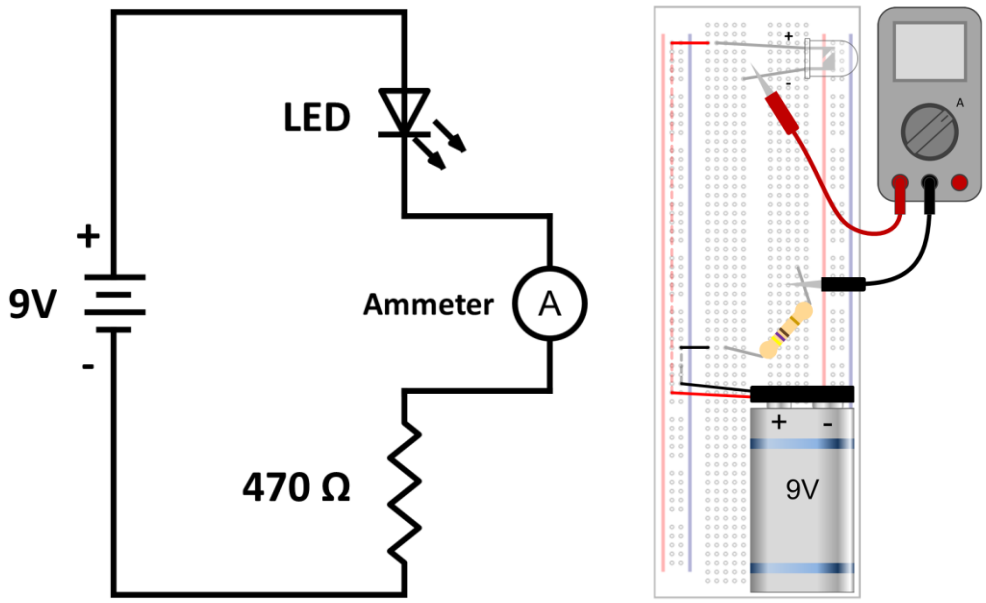
Fig. 6: Bottom, Side, and Top-views of an LED
Notice the lead length, the flat edge, and the larger triangular metal piece.



(a) (b)

Fig. 7: Simple LED Circuit
(a) Circuit Diagram, (b) Suggested Breadboard Wiring Diagram

Note: You are **not** required to measure the LED current for this lab, however, if you choose to, make sure to connect the ammeter in series as shown in Fig. 8 (black to COM, red to mA, mode dial set to 20m). Connecting it incorrectly could ruin your multimeter.



(a) (b)

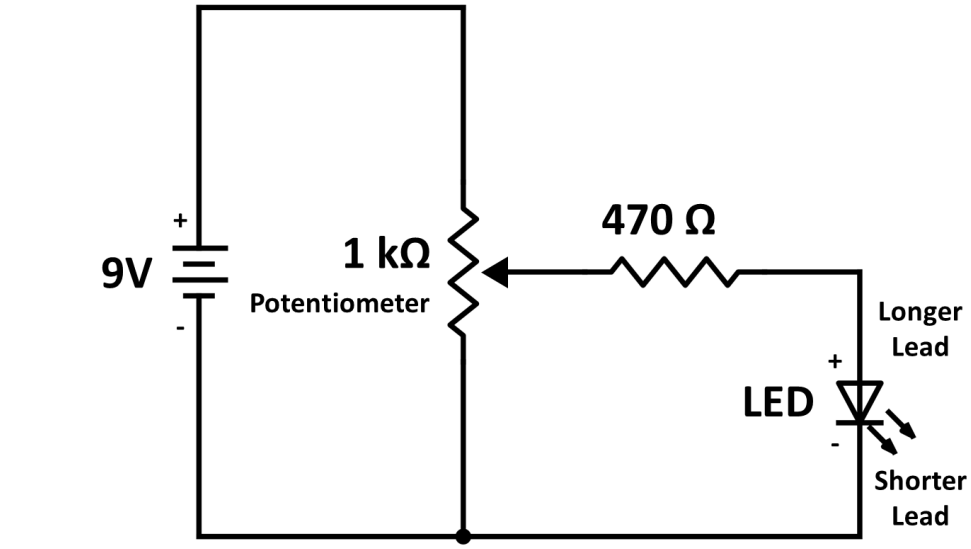
Fig. 8: Simple LED Circuit with Ammeter Inserted
(a) Circuit Diagram, (b) Suggested Breadboard Wiring Diagram
Note: Multimeter ports vary by model

Part 9 – Adjustable LED Circuit:

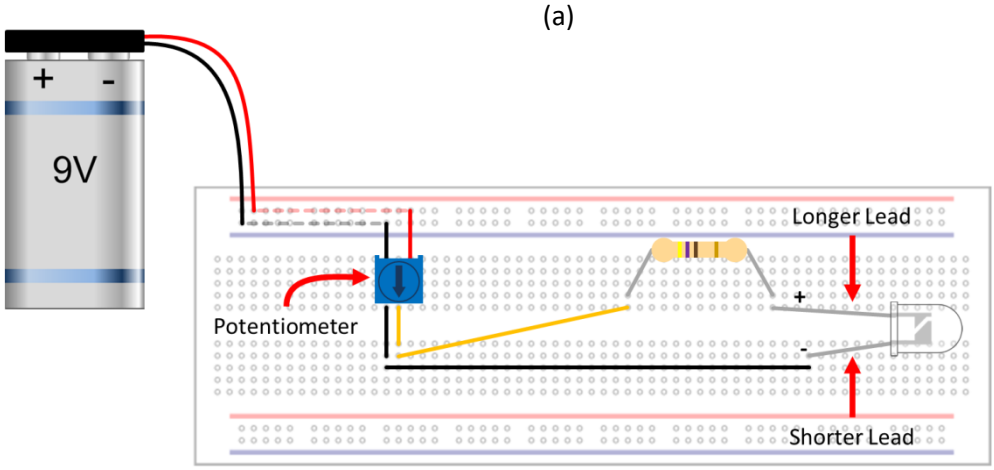
If you are running out of time at this point, just watch the rest of the video but don't build the final circuit. You will need to build this circuit for several of the later labs but if you are low on time, you can skip building it for now.

Watch this section in the video and build the adjustable LED circuit on your breadboard. Insert a picture of the completed circuit in your **eJournal**. The following diagrams may help you.

When you finish this step, remove the battery from the circuit and turn off the multimeter to save the batteries for future experiments and to extend the life of the circuit components.



(a)



(b)

Fig. 9: Adjustable LED Circuit
(a) Circuit Diagram, (b) Suggested Breadboard Wiring Diagram