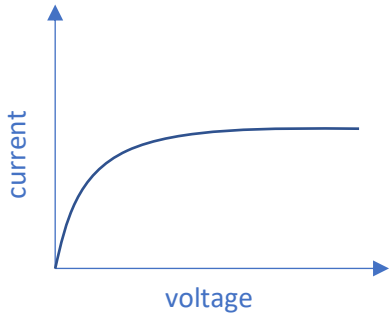
Representing Circuit Components with Functions

Electrical devices work through the flow of electrons, which are charged particles. For an electrical circuit to work, it must have something that provides power (like a battery), something that consumes power (like a resistor or LED), and wires must connect everything in a circle, so the electrons can flow. The battery has a given *voltage*, which provides the "umph" needed to get the electrons flowing. We call the flow of electrons *current*.

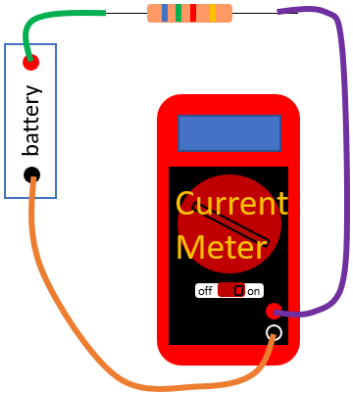
Some electrical components obey linear laws and others have more complicated relationships between voltage and current. Electrical engineers often represent the behavior of different circuit components by plotting their i-V curves, which is a graph relating current and voltage for that particular electrical component. Today we are going to create i-V curves for two basic circuit components—resistors and LEDs (Light Emitting Diodes)—to determine which is a linear circuit component and which is a nonlinear circuit component.

Example i-V curve: (for a transistor)



1) **RESISTOR.**

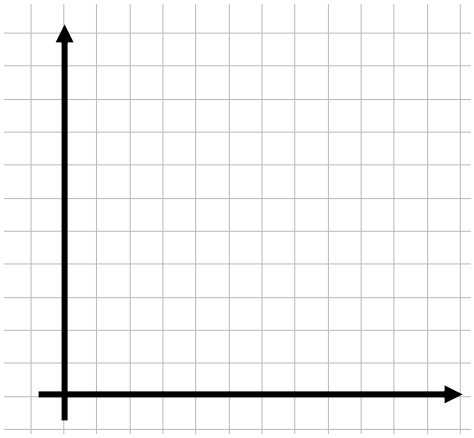
a) Build the following circuit, which includes a battery, a resistor, and the current meter in a loop. The current meter will measure the current. Use any resistor from the card, but make sure you use the same one for reach measurement. We will collect 3 different data points by changing the voltage. We will start with 1 battery, then add a second battery in a row and then a 3rd battery to get 3 different points.



Add batteries with red side in the same direction

1 battery:	2 batteries:	3 batteries:
Voltage = 1.5 Volts	Voltage = 3 Volts	Voltage = 4.5 Volts
Current = _____	Current = _____	Current = _____

b) Plot the data. Make sure to label your axes.



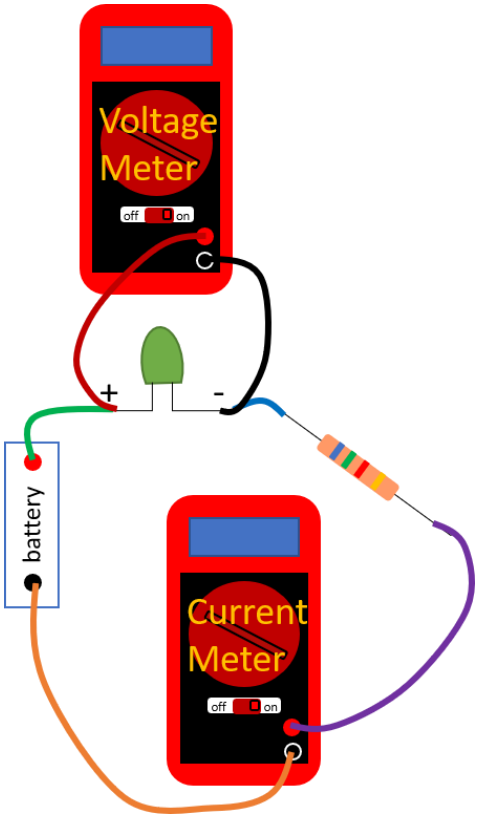
c) Is the relationship between current and voltage

LINEAR or NONLINEAR ? (circle one)

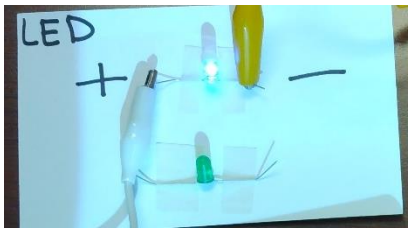
2) **LED.**

a) Build the following circuit, which has a battery, resistor, LED, and current meter in a loop. (Whenever we work with LEDs, we must also include a current-limiting resistor.) You should use the 0.1 resistor, but you can choose which color LED you want to use. The + side of the LED must connect to the red side of the battery. Just like before, we will use 1, 2, and 3 batteries to create 3 different data points for our plot.

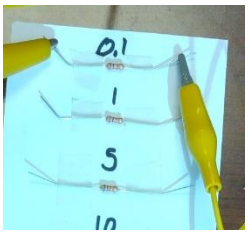
Since there are multiple circuit components in the loop with the battery, they split the voltage from the battery, so this time we must measure BOTH the voltage across the LED and current through the LED (before we could just use the voltage of the battery as our voltage). Connect the red wire from the VOLTAGE READER to the + side of the LED and the black wire from the voltage reader to the "–" side of LED.



LED card



Resistor card



1 battery:

Voltage = _____

Current = _____

2 batteries:

Voltage = _____

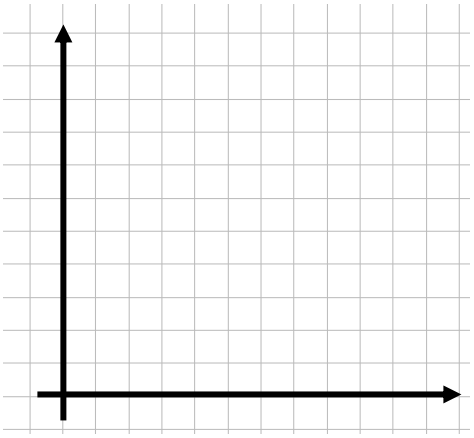
Current = _____

3 batteries:

Voltage = _____

Current = _____

b) Plot the data. Make sure to label your axes.



d) Is the relationship between current and voltage

LINEAR or NONLINEAR ? (circle one)

3) Which circuit component is represented by each equation?

$y = ax$ LED or RESISTOR

$y = a2.7^{bx} - a$ LED or RESISTOR