GSC International Inc.
Phone: 417.374.7431
Fax: 417.374.7442
Toll Free: 888.756.4592
service@gosciencecrazy.com
2076 James River Court
Nixa, Missouri 65714

Law of Resistance Kit
#RESKT

Warning:

- **Not a toy; use only in a laboratory or educational setting.**
- **California Proposition 65 Warning: This product can expose you to chemicals including styrene and lead, which are known to the State of California to cause cancer, birth defects, or other reproductive harm. For more information go to www.P65Warnings.ca.gov.**

Introduction

Resistance (R) is the measurement of how much an object or material slows the flow of electrical **current (I)** passing through it. It is measured in **Ohms (Ω),** and a material's resistance is mathematically defined as a ratio of the **voltage (V)** to its current **(R = V / I).** Parallels between resistance and mechanical friction can be made to help understand the concept. If you compare electricity passing through a wire to water passing through a pipe, it can help you to better visualize electrical resistance. For example, electrical resistance will increase the thinner and longer a wire gets.

With this kit you will be able to measure the resistances of several different materials, compare the resistance of two different gauge wires of the same material, and experiment with the resistance of various circuits.

Components

1. Resistance board with four wires connected to input sockets on each end of each wire
   24 Gauge (SWG) Constantan (copper-nickle alloy) Wire, 30 SWG Constantan Wire, 30 SWG Iron Wire, 30 SWG Copper Wire
2. Multimeter (x2)
3. Patch cords (x4)
4. Connecting cords with banana ends (x2 Red and x2 Black)

How to Use

Your kit will allow you to investigate the resistance properties of the four wires mounted on your platform. Follow the instructions below to properly test the resistance of each individual wire and the resistance of them connected together in various circuits:

Setting Up Your Multimeter

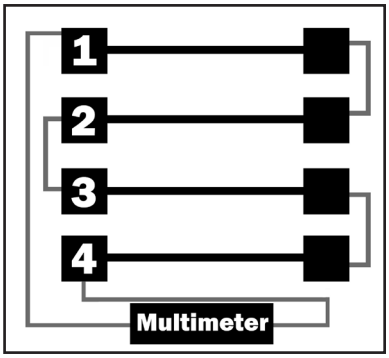
1. Decide whether you will be using the banana-end connecting cords or the needle-nose patch cords with your multimeter. When testing the resistance of an individual wire, you will get a clearer and more consistent reading using the connecting cords. Your patch cords will be useful when testing the resistance of circuits.
2. Plug your black cord into the jack labeled **COM** and your red cord into the jack labeled **V / Ω.**
3. Turn the dial on your multimeter to the **200** found underneath the **Ω. (Note:** Your multimeter can measure other electrical qualities, but you will only need its resistance function for this experiment.**)**
4. Use the button in the left-hand corner below the screen to turn your multimeter on.

Testing the Resistance of Each Wire

1. Set up your multimeter. Use your connector cord for the clearest results.
2. Plug the loose end of your black cord into the jack on the left side of the 24 SWG constantan wire on top of your resistance board. Plug the loose end of your red cord into the jack on the opposite end of the same wire.
3. Record the value displaying on your multimeter. This value will be $\mathbf{R_1}$.
4. Repeat this for each wire on the board. $\mathbf{R_2}$ will be the wire below $\mathbf{R_1}$ and so on through $\mathbf{R_4}$.

Testing Resistance of Wires Connected in Series

1. Set up your multimeter. Use your patch cords to connect to your multimeter.
2. Using the diagram to the right as a guide, connect the wires on your resistance board in a series circuit. Your kit includes enough connector cords to connect two, three, or four wires on the board in a series circuit.
3. Place the tips of your patch cords into the jacks of the two open ends of your connected wires, completing the circuit as seen in the diagram.
4. Record this value as $\mathbf{R_{TOTAL}}$. **(Note:** You may need to wait several seconds for your results to stabilize when using patch cords.**)**
5. Calculate the theoretical resistance of the circuit with the formula to the right using the resistance values for each individual wire that you gathered earlier.
6. Compare your measured result with the one you calculated.

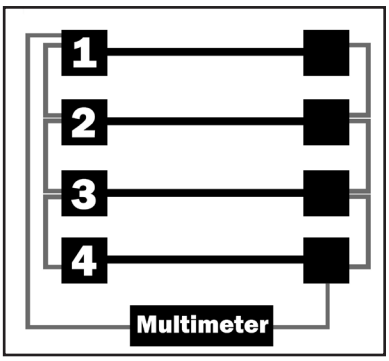


$$R_{Total} = R_1 + R_2 + R_3 + R_4 + \ldots$$

Series Circuit

Testing Resistance of Wires Connected in Parallel

1. Set up your multimeter. Use your patch cords to connect to your multimeter.
2. Using the diagram to the right as a guide, connect the wires on your resistance board in a parallel circuit. Your kit includes enough connector cords to connect two or three wires on the board in a parallel circuit. When you need to plug two cords into one jack to create a parallel circuit, you must plug one cord into the top of the one you already have plugged into the jack on the board.
3. Place the tips of your patch cords into the jacks or cords at two points farthest from each other on the circuit.
4. Record this value as $\mathbf{R_{TOTAL}}$.
5. Calculate the theoretical resistance of the circuit with the formula to the right using the resistance values for each individual wire that you gathered earlier.
6. Compare you measured result with the one you calculated.
7. Repeat this experiment several times using parallel circuits made with different combinations of wires.



$$\frac{1}{R_{Total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} + \ldots$$

Parallel Circuit