Ohm's Law activity using Tinkercad®

Ohm's Law describes the relationships between voltage, current and resistance in any electrical circuit.

By SpinningSpark (Self created using Inkscape) [CC BY-SA 3.0], via Wikimedia Commons

The picture to the right represents the three equations that describe this relationship:

- V=IxR
- I=V/R
- R=V/I

Where V is voltage, I is current and R is resistance.

If you are not familiar with how to use Tinkercad® circuits then watch the **"Introduction to Tinkercad"** video before using the following steps:

1) Log in to your existing account, or create a new account by clicking on the 'Sign Up' button on the Tinkercad® website at https://www.tinkercad.com

2) Create a new **circuit**.

3) Open the **Components** menu, select **"All Components",** find the **light bulb** and drag it into the workspace. Instead of looking through the list, you can click the search window and start typing the name of any component you are searching for.

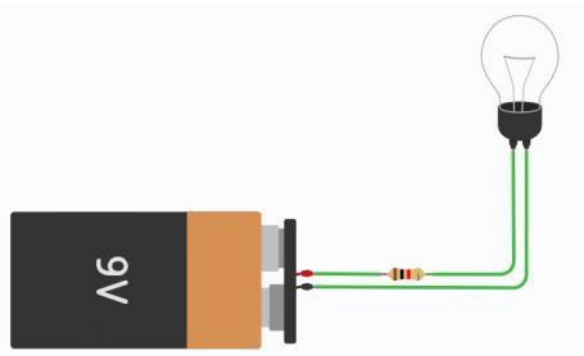
4) Drag a **resistor** into the workspace.

5) Find the **9V battery** and drag that into the workspace. You may like to rotate the battery or other components by using the button above the workspace while the component is selected.

6) Connect a wire from the positive terminal of the 9V battery (red), to one side of the resistor.

7) Connect a wire from the other side of the resistor to a terminal of the light bulb.

8) Connect a wire from the other terminal of the light bulb to the negative terminal of the battery.



Your circuit may look similar to this.

"Autodesk screen shots reprinted courtesy of Autodesk, Inc."

9) Click the "Start Simulation" button. If your circuit is correctly connected then you will see the light bulb turn yellow, to indicate it is on.

10) Current is flowing around the circuit from the positive terminal of the battery to the negative terminal. We can increase the amount of current flow by reducing the resistance. Click on the resistor and a small window will open where you will see that it has a value 1kΩ (1000 Ohms).

11) Click the drop-down menu and change the resistance from 1kΩ to 1Ω.

You will see the light bulb increase in brightness. Lower resistance in the circuit has allowed more current to flow. An increase in current means an incandescent light bulb will become brighter.

12) While the simulation is still running, increase the resistor value from 1Ω to 10Ω, then 100Ω and so on. As the resistance increases, the light bulb will become dimmer as less current flows. When you get to 1 hundred thousand Ohms (or 100kΩ) the light will look like it is turned off, because very little, or no current is flowing.

13) Reduce the resistance back to 100Ω

Now we will look at the effect that changing the voltage has on current when the resistance is kept at the same value.

14) Click the "Stop Simulation" button which will turn the light bulb off.

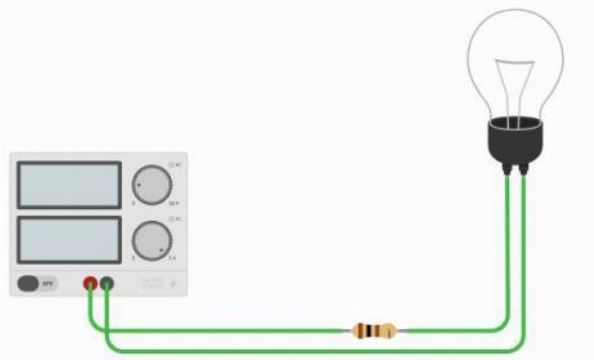
15) Click to select the **9V battery**. It will have a blue outline.

16) Press the Delete key on your keyboard or use the Delete button towards the top of the screen. The battery and the wires connected to it will disappear.

17) Open the Components menu and find the **Power Supply**. Put this where the battery was.

18) Connect a new wire from the red terminal of the power supply to the resistor.

19) Also connect a wire from the black terminal to the light bulb.



Your circuit may look similar to this.

"Autodesk screen shots reprinted courtesy of Autodesk, Inc."

20) Start the simulation again. You will see the power supply turn on and it will be set to a default voltage of 5.00V. The other screen on the power supply will give a measurement of the current flowing in the circuit. The light bulb will also be on.

21) Click and hold the top dial on the power supply to slowly adjust the voltage up and down. It has a range of 0 to 30V.

You will see the light bulb get brighter as voltage increases, and dimmer as voltage decreases. This brightness is proportionate to the current flowing through it.

22) Reduce the voltage back to 9.00V. If it is difficult to be accurate by turning the dial with your mouse, you can alternatively click to highlight the power supply and type the voltage in the window that opens.

23) Lower the resistor value to 10Ω

What is the reading given for current in the lower window of the power supply (in mA)?

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Keep the resistor the same and slowly increase the voltage using the dial on the power supply. Above which voltage (approximately) does the light bulb burn out?

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Tip: On Tinkercad's® circuit simulator, hover your mouse over a burnt out component for more information on the problem.

A burnt out light bulb
"Autodesk screen shots reprinted courtesy of Autodesk, Inc."

To summarise:

- *A change in voltage is directly proportional to a change in current, i.e. more voltage means more current.*
- *A change in resistance is inversely proportional to a change in current, i.e. more resistance means less current.*
- *These are both supported by the Ohm's law equation I = V/R*
- *A change in either voltage, current or resistance will affect the other parts of the equation for an electrical circuit.*
- *Knowing any two of these values will allow the third value to be calculated.*