

## Ohm's Law

One of the most important and basic laws of electrical circuits is Ohm's law which states that the current passing through a conductor is proportional to the voltage over the resistance.

### Equation

Ohm's law may sound a bit confusing when written in words, but it can be described by the simple formula:

$$I = \frac{V}{R}$$

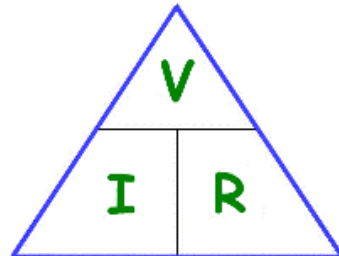
where I = current in amps, V = voltage in volts, and R = resistance in ohms

This same formula can also be written in order to calculate for the voltage or the resistance:

$$I = \frac{V}{R} \quad \text{or} \quad V = IR \quad \text{or} \quad R = \frac{V}{I}$$

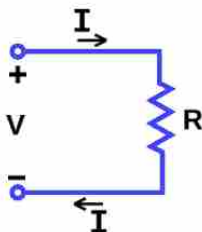
### Triangle

If you ever need help in remembering the different equations for Ohm's law and solving for each variable (V, I, R) you can use the triangle below.



### Circuit Diagram

Here is a diagram showing I, V, and R in a circuit. Any one of these can be calculated using Ohm's law if you know the values of the other two.



How Ohm's Law Works

Ohm's law describes the way current flows through a resistance when a different electric potential (voltage) is applied at each end of the resistance. One way to think of this is as water flowing through a pipe. The voltage is the water pressure, the current is the amount of water flowing through the pipe, and the resistance is the size of the pipe. More water will flow through the pipe (current) the more pressure is applied (voltage) and the bigger the pipe is (lower the resistance).

## Example Problems

1. If the resistance of an electrical circuit is increased, what will happen to the current assuming the voltage remains the same?

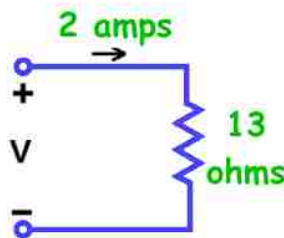
Answer: The current will decrease.

2. If the voltage across a resistance is doubled, what will happen to the current?

Answer: The current will double as well.

Explanation: If you look at the equation  $V = IR$ , if  $R$  stays the same then if you multiple  $V \times 2$  (double the voltage), you must also double the current for the equation to remain true.

3. What is the voltage  $V$  in the circuit shown?



Answer:  $V = I \times R = 2 \times 13 = 26$  volts

## Interesting Facts about Ohm's Law

It is generally applied only to direct current (DC) circuits, not alternating current (AC) circuits. In AC circuits, because the current is constantly changing, other factors such as capacitance and inductance must be taken into account.

The concept behind Ohm's law was first explained by German Physicist Georg Ohm who the law is also named after.

The tool for measuring volts in an electric circuit is called a voltmeter. An ohmmeter is used for measuring resistance. A multimeter can measure several functions including voltage, current, resistance, and temperature.

## Electrical Wiring 110 Ohm's Law

### Questions:

1. According to Ohm's Law, current equals the voltage divided by the \_\_\_\_\_.
  - a. Resistance
  - b. Inductance
  - c. Capacitance
  - d. Power
  - e. Conductance
2. What equation would you use to solve for voltage?
  - a.  $V = I/R$
  - b.  $V = PR$
  - c.  $V = CI$
  - d.  $V = IR$
  - e.  $V = R/I$
3. What does the letter 'I' stand for in Ohm's Law?
  - a. Resistance
  - b. Inductance
  - c. Capacitance
  - d. Voltage
  - e. Current
4. What does the letter 'R' stand for in Ohm's Law?
  - a. Resistance
  - b. Inductance
  - c. Capacitance
  - d. Reactance
  - e. Rate of change
5. If the current in an electrical circuit is constant, what will happen to the voltage if the resistance is increased?
  - a. The voltage will decrease
  - b. The voltage will increase
  - c. The voltage will stay the same
6. If there are 10 Volts across a 5 Ohm resistor, what is the current?
  - a. 0.5 Amps
  - b. 1 Amp
  - c. 2 Amps
  - d. 15 Amps
  - e. 50 Amps
7. If there are 40 Volts and 5 Amps running through an electrical circuit, what is the resistance of the circuit?
  - a. 1 Ohm
  - b. 2 Ohms
  - c. 4 Ohms
  - d. 6 Ohms
  - e. 8 Ohms
8. If there are 7 Amps running through a 3 Ohm resistor, what will the voltage be across the resistor?
  - a. 2.5 Volts
  - b. 10 Volts
  - c. 17 Volts
  - d. 21 Volts
  - e. 42 Volts
9. If you increase the voltage across a resistor, what will happen to the current?
  - a. The current will decrease
  - b. The current will increase
  - c. The current will stay the same
10. If you increase the size of the resistor and keep the voltage the same, what will happen to the current?
  - a. The current will decrease
  - b. The current will increase
  - c. The current will stay the same