Ohm's Law

Voltage, or a difference in electric potential energy, is needed for electric current to flow. As you might have guessed, greater voltage results in more current. Resistance, on the other hand, opposes the flow of electric current, so greater resistance results in less current. These relationships between current, voltage, and resistance were first demonstrated by a German scientist named Georg Ohm in the early 1800s, so they are referred to as **Ohm's law**. Ohm's law can be represented by the following equation.

$$\text{Current (amps)} = \frac{\text{Voltage (volts)}}{\text{Resistance (ohms)}}$$

$$V \div I_{\tau}$$

$$\Omega \leftarrow omega$$

Understanding Ohm's Law

You may have a better understanding of Ohm's law if you compare current flowing through a wire from a battery to water flowing through a garden hose from a tap. Increasing voltage is like opening the tap wider. When the tap is opened wider, more water flows through the hose. This is like an increase in current. Stepping on the hose makes it harder for the water to pass through. This is like increasing resistance, which causes less current to flow through a material. Still not sure about the relationship among voltage, current, and resistance? Watch the video at this URL: http://www.youtube.com/watch?v=KvVTh3ak5dQ(2:00).

$$V = I_{\tau} R$$

Ohm's Law: Example Problems

Solve for the missing value:

$40 \ \Omega = R$

1. V= 6.0
   I= 0.15
   R=?

$$V = I \times R \quad \leftarrow V = IR$$
$$6 = 0.15 \times R$$
$$6 = 0.15R \qquad \frac{6}{0.15} = \frac{0.15R}{0.15}$$
$$6 = 0.15R$$

2. V= ?
   I= 0.5
   R=240

$$V = IR$$
$$V = (0.5)(240)$$
$$\boxed{V = 120V}$$

3. V= 120
   I= ?
   R=100

$$V = IR$$
$$120 = I(100) \qquad \frac{120}{100} = \frac{100I}{100}$$
$$120 = 100I \qquad \boxed{1.2 \ A = I}$$

4. V=?
   I= 4.60
   R= 26

Ohm's Law: Example Problems

5. V=120
   I= ?
   R= 14

6. V= 240
   I= ?
   R= 12.8

7. Calculate the resistance of a light bulb that has a voltage of 6.0 V and a current of 0.25 amps.

$R = ?$ $v = IR$

$v = 6.0V$ $6 = (0.25)R$

$I = 0.25A$ $\boxed{24\,\Omega = R}$

8. What is the current if a 120V battery has 240Ω of resistance?

$I = ?$ $V = IR$

$V = 120V$ $120 = I(240)$

$R = 240\,\Omega$ $\boxed{0.5\,A = I}$