PLTW Engineering

10-12/Basic Ohms Law Calculations

4/13/2020

10-12/DE

Lesson: **4/13/2020**

Objective/Learning Target: Students will be able to solve for unknown theoretical values in a basic electrical circuit

The 3 variables of an electrical circuit are:

Resistance (R) – Measured in Ohms (Ω)

Current (I) – Measured in Amperes (A)

Voltage (V) – Measured in Volts (V)

Resistance (R) (Ω)

Resistance is the opposition to the flow of electricity within a circuit.

Resistance limits how much or how fast current can travel.

Think of resistance like a water faucet handle. You can limit how much water flows.

Voltage (V) (V)

Voltage is the variable that powers an electrical circuit.

Voltage is the force that causes current to flow.

Think about air pushing water through a hose. This is similar to how voltage pushes through a circuit.

Current (I) (A)

Current is the rate at which electricity is flowing through a circuit.

Current flows from the positive end of the power source (+) to the negative end of the power source (-).

Think of a speedometer on a car dashboard. The speedometer shows how fast the vehicle is traveling.

Electrical Circuits

In an electrical circuit, the voltage, current, and amps are all related.

The mathematical relationship that exists between them means that when one of the values changes, so do the others.

We call this relationship Ohm's law after the scientists who discovered it.

Ohms Law

To clearly define ohm’s law :

Current in a resistor varies in direct proportion to the voltage applied to it, and is inversely proportional to the resistors value.

Ohms Law

Mathematically this looks like the following equation:

$$I = V/R$$

Current (I) = Voltage (V) / Resistance (R)

Ohms Law

Again, because of the mathematical relationship between each of the variables, we can rearrange the basic equation to solve for any of the others:

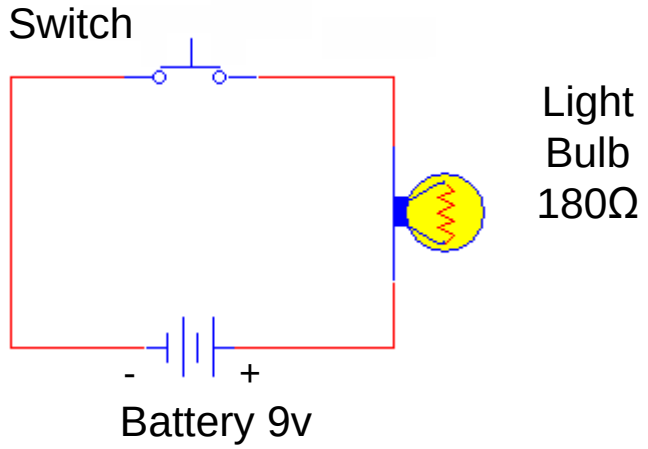
$$I = V/R \text{ (Answer in Amps (A)}$$

$$R = V/I \text{ (Answer in Ohms (}\Omega\text{)}$$

$$V = IR \text{ (Answer in Volts (V)}$$

Ohms Law

So how does this relate to a circuit? To answer that question lets take a look at a very basic circuit; a flashlight.



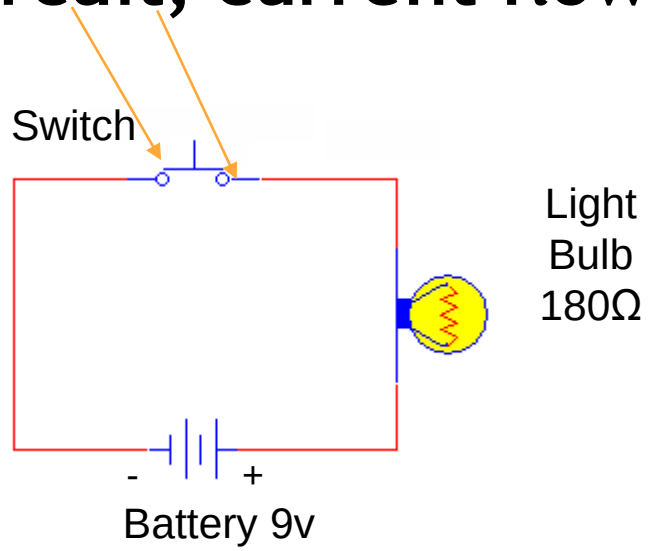
Ohms Law Calculations

You can see that with the switch closed and making contact with the circuit, current flows, and lights up the blub.

The power source is 9V.

The resistance is 180Ω.

The current is unknown.



Ohms Law Calculations

In this case we must use the equation set up to solve for current (I) in Amps (A)

I = V/R (Answer in Amps (A)

R = V/I (Answer in Ohms (Ω)

V = IR (Answer in Volts (V)

Ohms Law Calculations

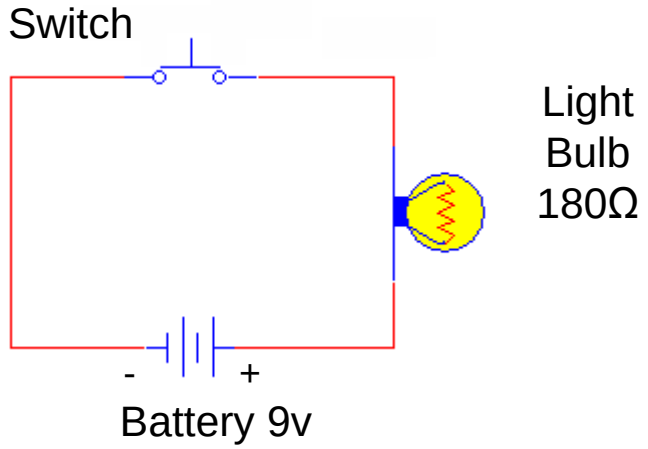
The power source is 9V.

The resistance is 180Ω.

I = V/R

I = 9v / 180Ω

I = 0.05 A



Ohms Law Calculations

$I = V/R$

$I = 9v / 180\Omega$

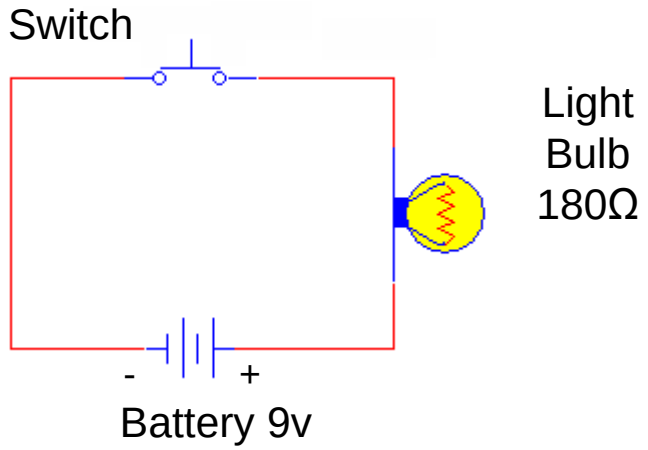
$I = 0.05\ A$

Because the answer begins with a zero we need to change the units to an SI prefix that gives us a whole number. In this case moving the decimal to the right 3 places will give us miliAmps or mA.

Ohms Law Calculations

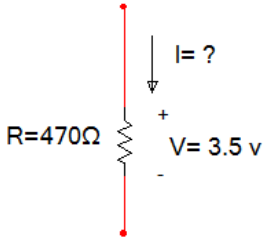
Our final answer for the current in this circuit would be:

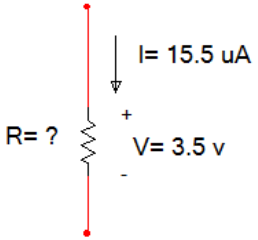
$$I = 50\ mA$$

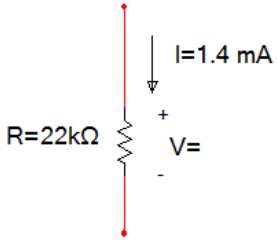


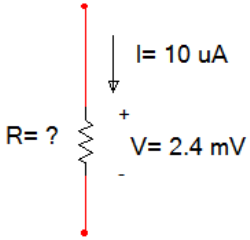
Practice Ohms Law Calculations

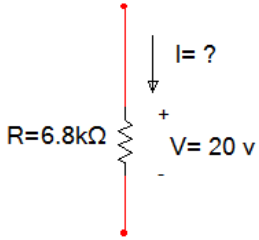
Here are some basic circuit calculations you can try.

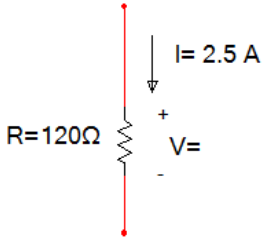












Helpful Links

[All about circuits – Ohm’s Law]

[Electronics Tutorials – Ohm’s Law]