Applications of Ohm's Law

ELTN 130

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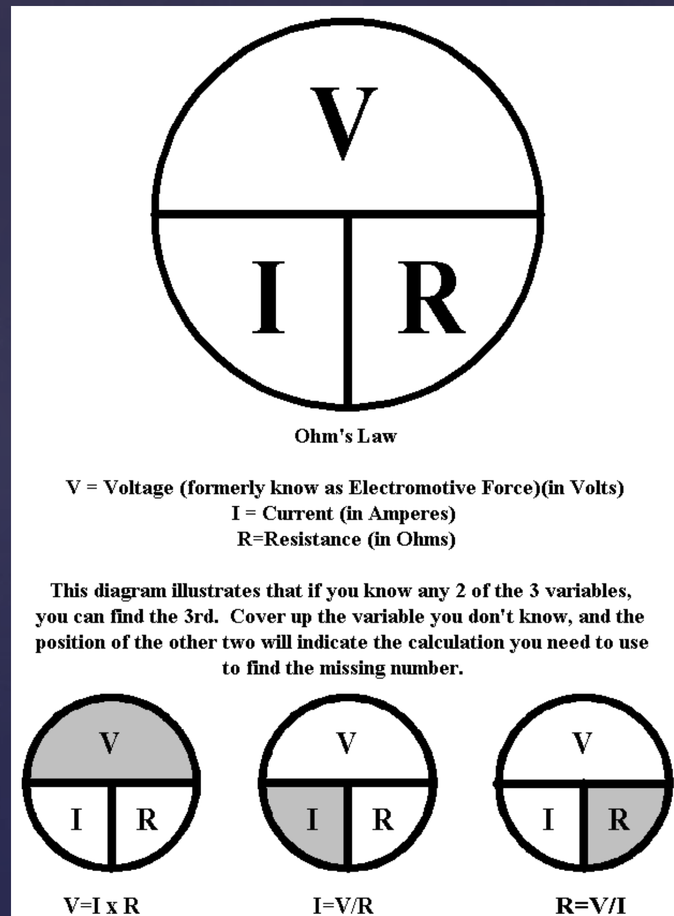
Ohm’s law describes the relationship between Voltage (V), Current (I) and Resistance (R).

Mathematically speaking:

$V = I \times R$
$I = V \div R$
$R = V \div I$

For those who like visuals…



www.dccwiki.com

What does this mean in practical applications? Let's look at current:

$I = V \div R$

If V = 10 V, R = 10 Ω, then:

$I = 10V \div 10\ \Omega =$ **1 Amp**

If V doubles, and R stays the same, what happens to the current?

$I = 20V \div 10\ \Omega =$ **2 Amps**

Notice that the current changes <u>proportionally</u>. This is called a *linear* equation – represented by a straight line…

http://phet.colorado.edu/sims/ohms-law/ohms-law_en.html

What does this mean in practical applications? Let's look at resistance:

$$R = V \div I$$

If V = 1 V and I = 1 Amp, then R = 1V / 1A = 1 Ω.

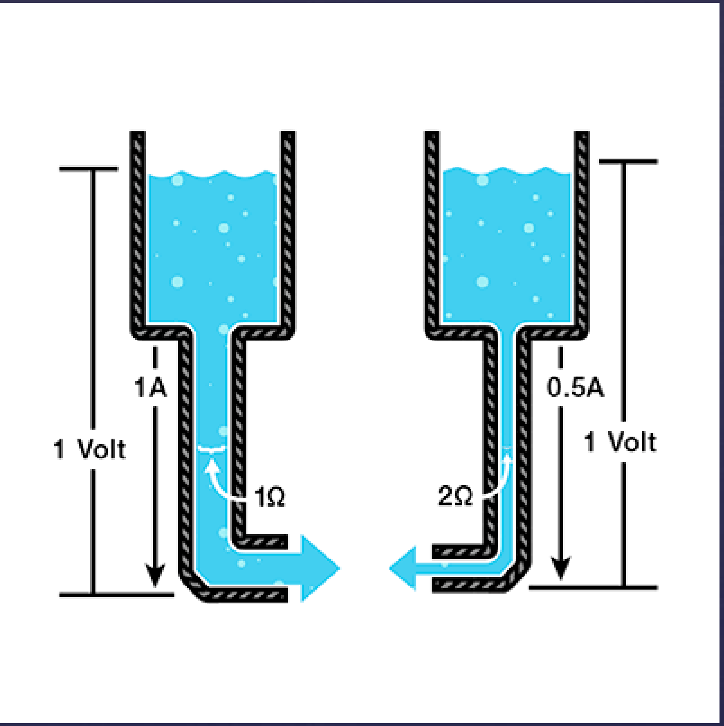
If V stays the same, but the current doubles, how has the resistance changed? <u>Remember</u> – if the voltage is the same and *current increases*, that means the *resistance has decreased*.

R = 1V ÷ 2 A = 0.5 Ω, or 500m Ω

In this case the resistance changes proportionally to the change in current. This again is a *linear* equation.

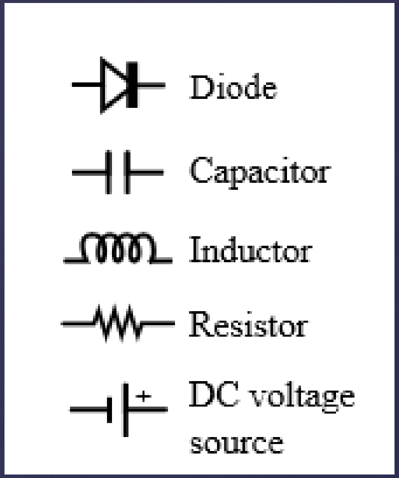
This can be described by the flow of water.

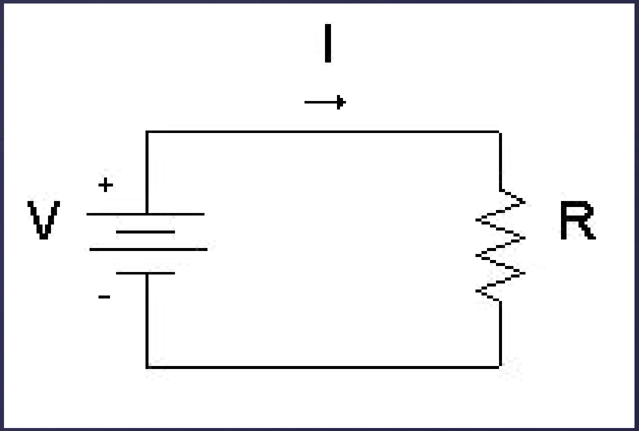
If the resistance <u>increases</u>, <u>less</u> current can flow:



Excellent tutorial at: https://learn.sparkfun.com/tutorials/voltage-current-resistance-and-ohms-law

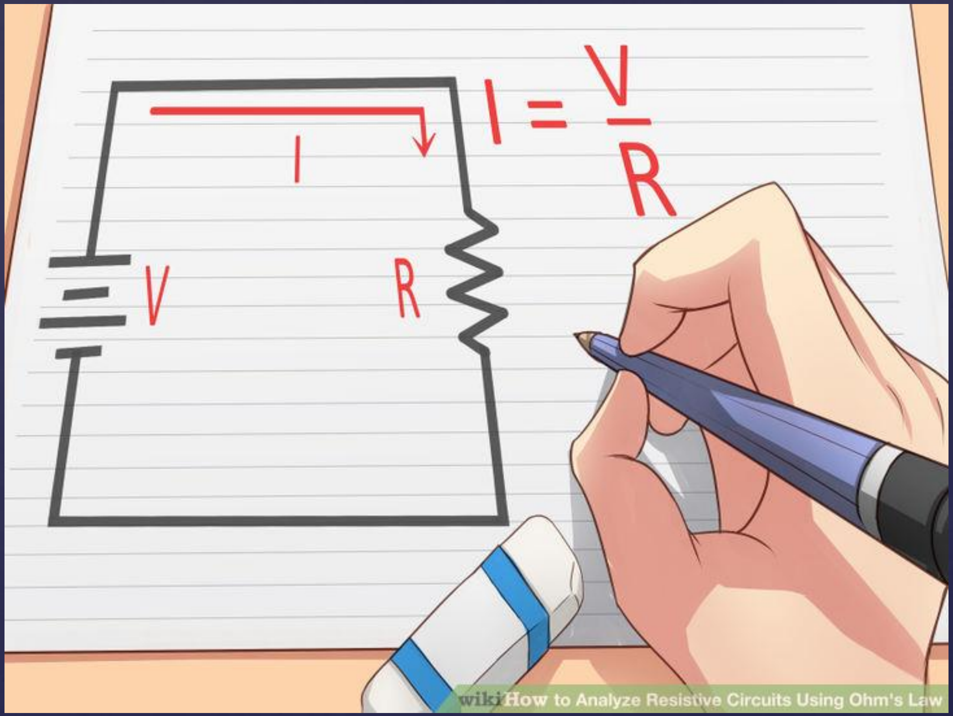
When drawing circuits, we use *schematic symbols* to represent different electronic devices. These include batteries (or power supplies), resistors, and other components:





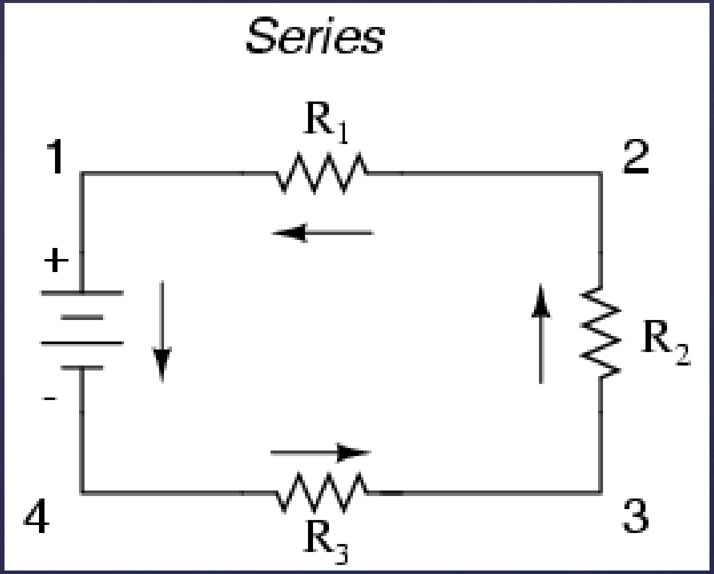
In a very basic circuit, we use a voltage source (V) and a single resistor (R). Current is shown as an arrow.

As long as we know two of the variables (Voltage, Resistance, or Current) we can solve for the missing variable. Let's practice drawing a few circuits and calculate for the missing variable:



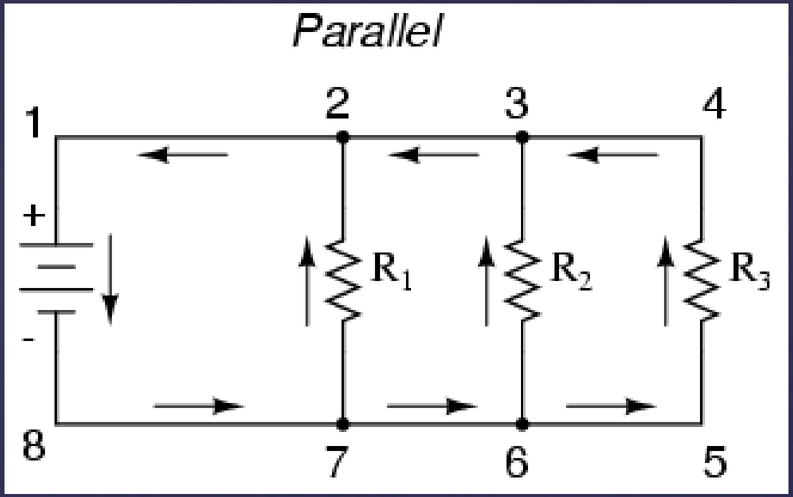
Resistors – how they work when connected together...

Resistors can be connected together in two basic ways: *Series* and *Parallel*.



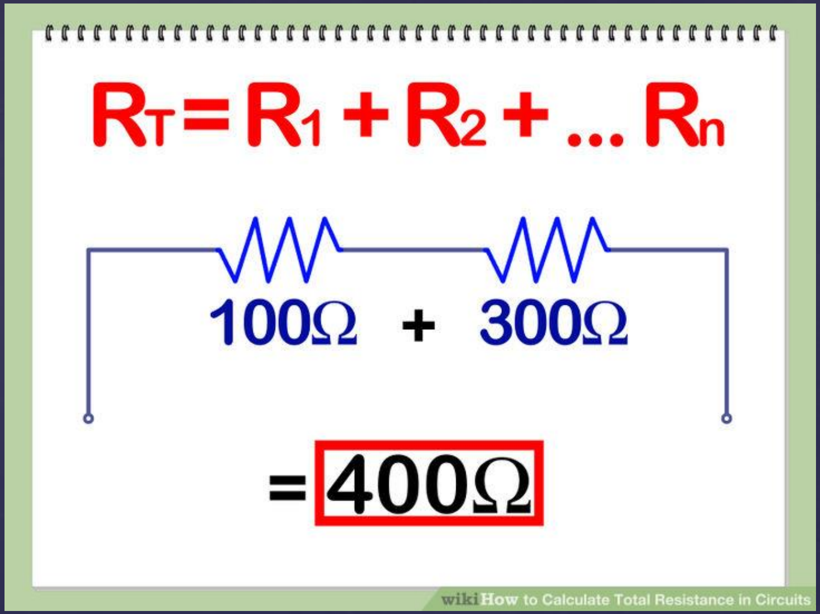
In *Series circuits* each of the resistors are connected end to end.

Resistors – how they work when connected together...



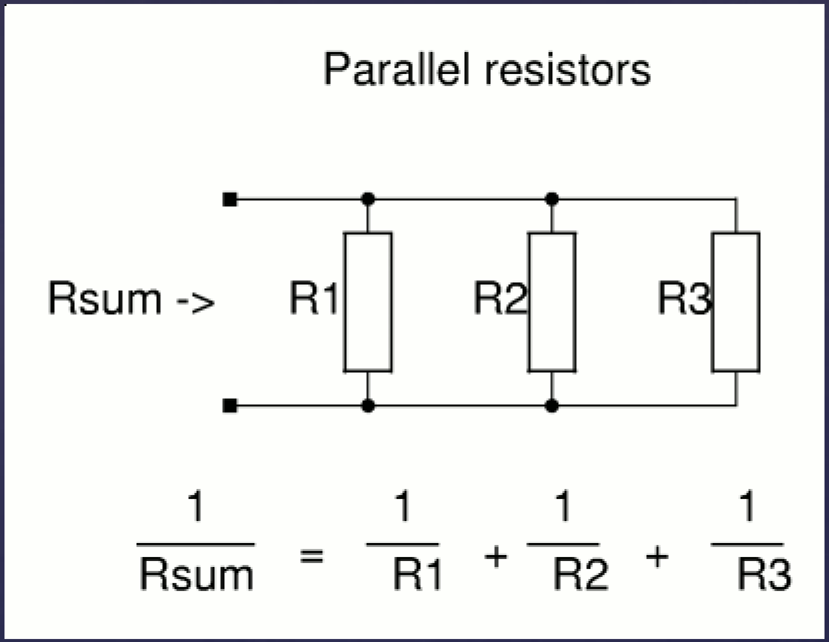
In *Parallel circuits* both of the end terminals of each resistor are connected together.

Formulas for Series and Parallel resistors:



R_T = "Total Resistance" = R1 + R2 + R3… for however many resistors there are in the circuit.

Formulas for Series and Parallel resistors:



Rsum = R_T = "Total Resistance" $1/R_T = 1/R1 + 1/R2 + 1/R3$… for however many resistors there are in the circuit. A little more complicated!

The difference between serial and parallel...

https://www.youtube.com/watch?v=O8GgRIIB1Yc

http://www.allaboutcircuits.com/textbook/direct-current/chpt-5/what-are-series-and-parallel-circuits/

Practice time!!