IAT 884 Workshop

Basic Electronics

Basic Concepts

Voltage = Electrical Potential

The volt is the unit measure of electrical pressure.

Amps = Current

Current is the measure of the flow of electrons passing through a given point in a circuit in a given amount of time

Ohms (Ω) = Resistance

Resistance is the measure of a device's opposition to the flow of electrical current.

Watts = Power

Power is a measure of the amount of work that is being done at a given point in time. To calculate power use the formula:

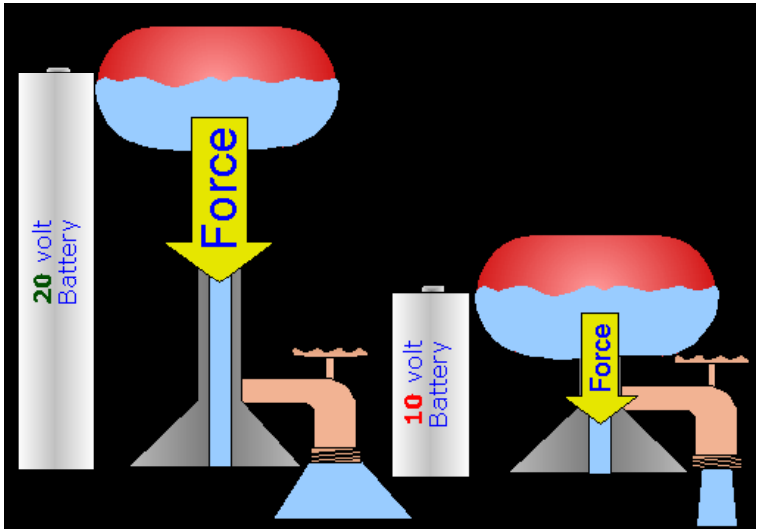
Watts = Volts * Amps

A Simple Water Analogy

Voltage = Water Pressure

Amps = Current Flow

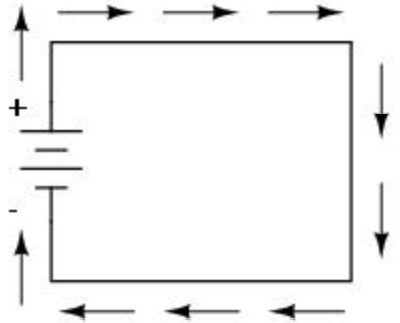
Ohms = Valve



The Flow of Electricity

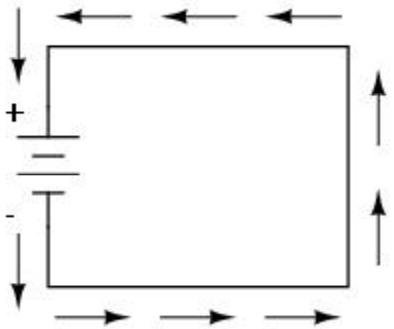
Conventional Flow:

Current is viewed as flowing from positive (+) to negative (-) terminals. This is how engineers talk about electricity.



Electron Flow:

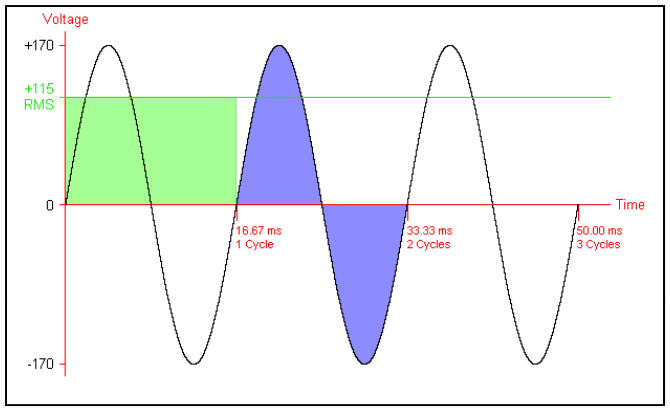
In actuality, current flows from negative to positive. It is the movement of electrons from high density to low density.



AC vs. DC Current

Alternating Current:

An electrical current whose magnitude and direction vary cyclically. This is the power we plug things into at home.



AC Current

Direct Current:

An electrical current in which the electric charges flow in the same direction. The kind of current produced by batteries.

Common Components

Breadboard: Simple way to connect components without using solder.

Wire: Passes current from one part of a circuit to another.

Power Supply: Supplies electrical energy.

Switch: An on-off switch allows current to flow only when it is closed (on).

Resistor (and Variable Resistor): Restricts the flow of current.

Capacitor: Stores electric charge.

Diode (General Purpose): Only allows current to flow in one direction.

LED (Light Emitting Diode): A transducer that converts electrical energy to light.

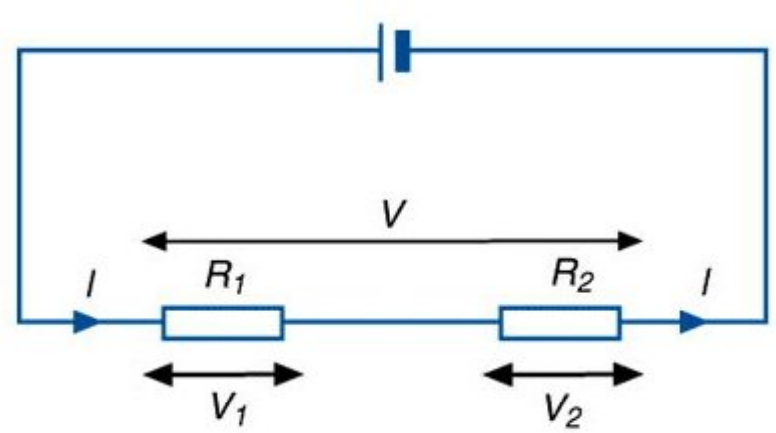
Transistor: Can be used as a switch or amplifier.

Relay: A switch that is controlled by another electrical circuit.

Voltage Regulators: Convert a higher voltage into a lower usable voltage

Series Circuit

An electrical circuit in which the components are connected end to end, so that the current flows through them all one after the other.



Voltage:

$V_T = V_1 + V_2$

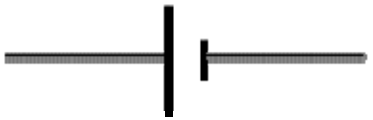
Resistance:

$R_T = R_1 + R_2$

Current:

$I_T = I_1 = I_2$

Schematic Symbols



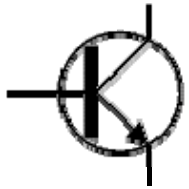
Cell

LED

Switch

Capacitor

Resistor

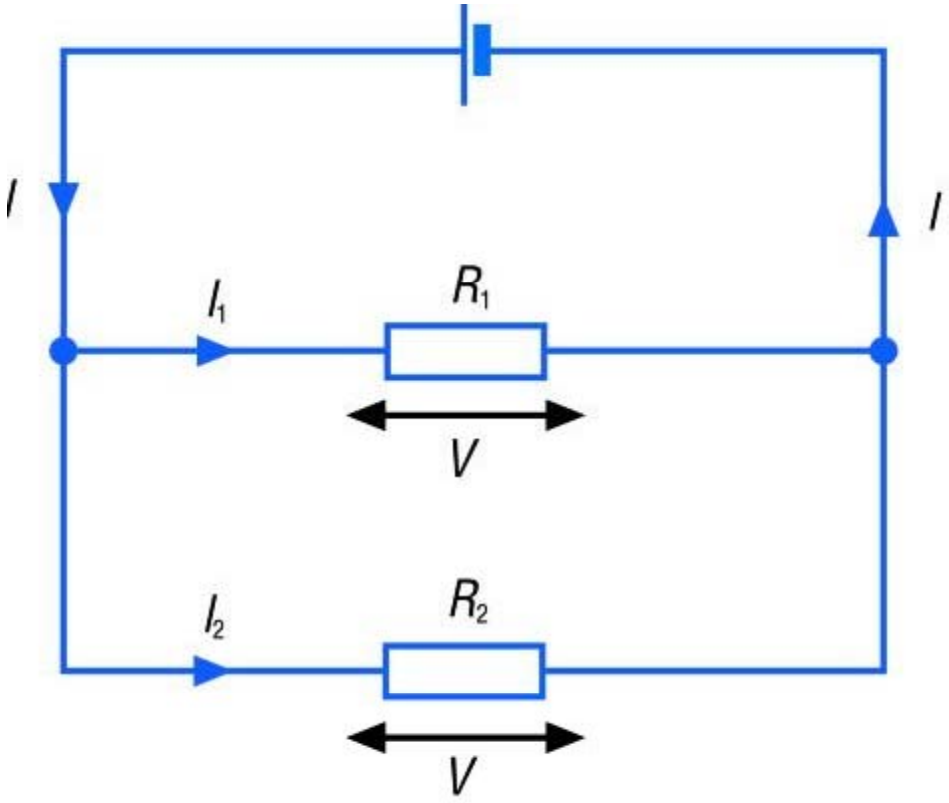


Transistor

Diode

Parallel Circuit

An electrical circuit in which the components are connected side by side. The current flowing in the circuit is shared by the components.



Voltage:

$V_T = V_1 = V_2$

Resistance:

$1/R_T = 1/R_1 + 1/R_2$

Current:

$I_T = I_1 + I_2$

Ohm's Law

V=IR

One amp of current will flow through a resistance of one ohm if one volt of electrical force is applied to the circuit.

V=Volts
I=Amps
R=Ohms

Applying Ohm's Law

12 Volt Power Supply
24 Ω Resistor

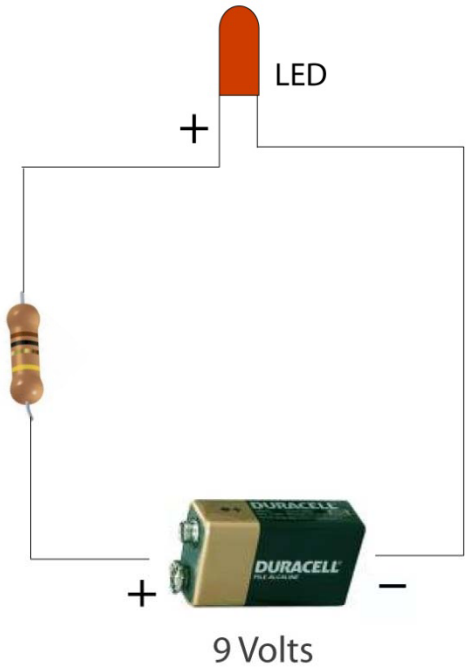
V = 12 Volts
R = 24 Ohms

Then…

I = V/R
I = 12 / 24
I = ½ Amp

Applying Ohm's Law

Choosing an LED



R=V/I

Calculate Voltage:

VS = supply voltage = 9 Volts
VL = LED voltage = ~ 2V for Red LEDs
V= (VS - VL) = (9V - 2V) = **7 Volts**

Calculate Amperage:

I = LED current = ~ 20mA = **.02A**

R = 7V / 0.02A
R = 350 Ω

Any resistor equal or greater than 350Ω will work, but higher values will dim the LED more.