

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 ( $\Omega$ ) = 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:

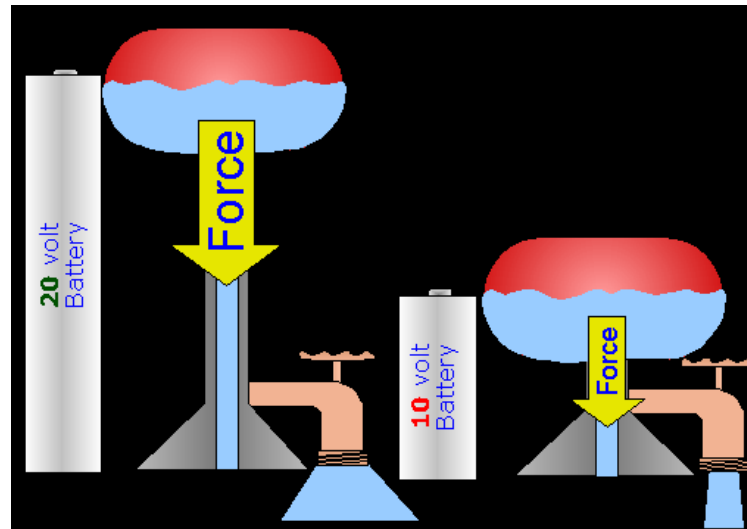
Watts = Volts \* Amps

# A Simple Water Analogy

**Voltage** = Water Pressure

**Amps** = Current Flow

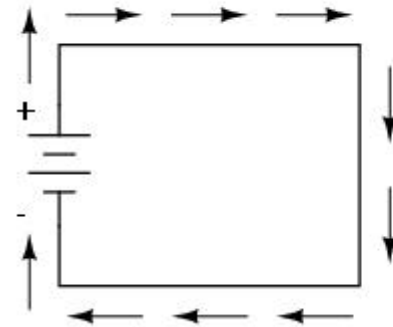
**Ohms** = Valve



# The Flow of Electricity

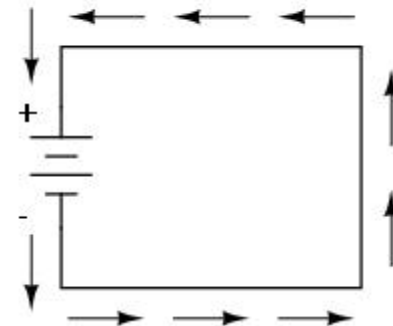
## Conventional Flow:

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.



# 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  $\Omega$  Resistor

**V = 12 Volts**

**R = 24 Ohms**

Then...

**I = V/R**

**I = 12 / 24**

**I = 1/2 Amp**



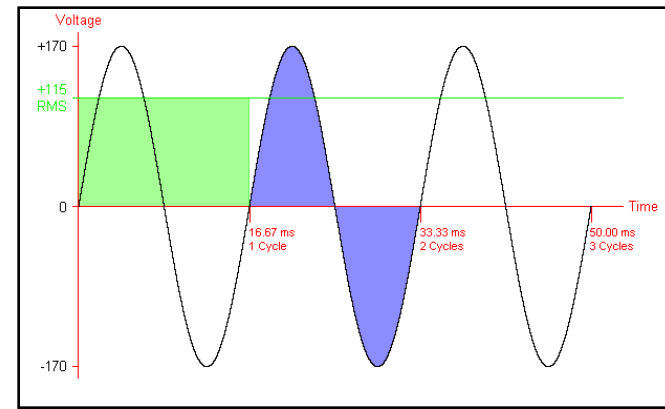
# AC vs. DC Current

## Alternating Current:

An electrical current whose magnitude and direction vary cyclically. This is the power we plug things into at home. 120V 60HZ

## Direct Current:

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



AC Current

# 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. Omega Ohm

**Capacitor:** Stores electric charge. Base unit read Farad (uF)

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

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

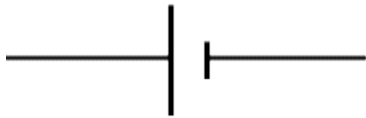
**Transistor:** Can be used as a switch or amplifier.

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

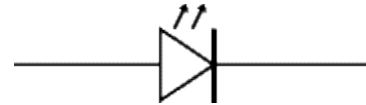
**Voltage Regulators:** Convert a higher voltage into a lower usable voltage



# Schematic Symbols



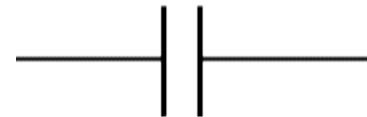
Cell



LED



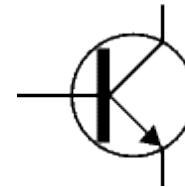
Switch



Capacitor



Resistor



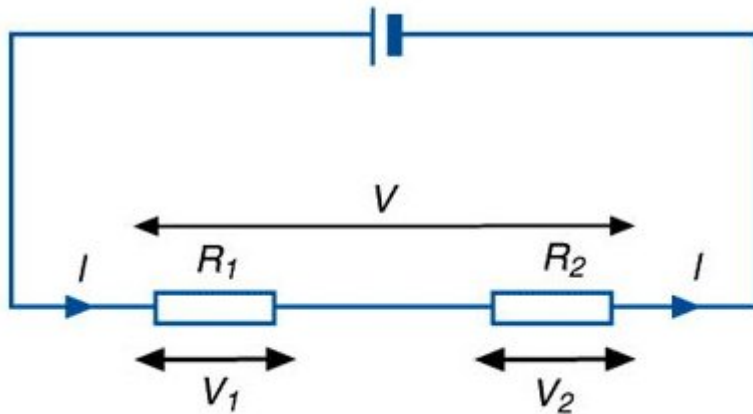
Transistor



Diode

# 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:**

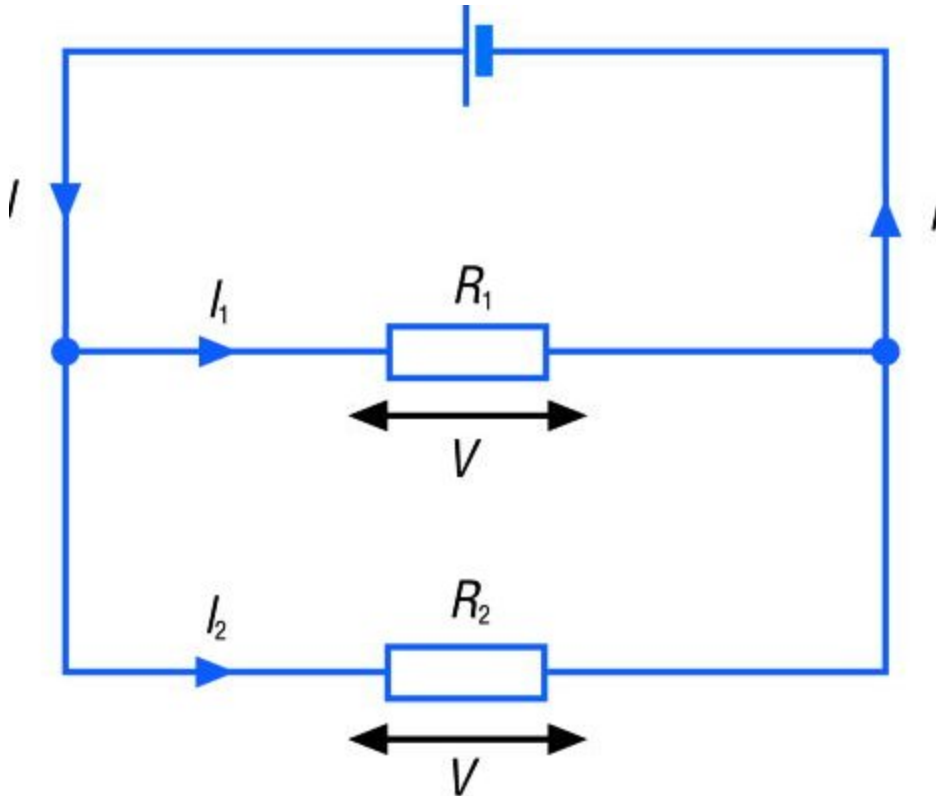
$$R_T = R_1 + R_2$$

**Current:**

$$I_T = I_1 = I_2$$

## 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:**

$$I_T = I_1 + I_2$$

# Applying Ohm's Law

## Choosing an LED

$$R = V / I$$

### Calculate Voltage:

$V_S$  = supply voltage = 9 Volts

$V_L$  = LED voltage = ~ 2V for Red LEDs

$V = (V_S - V_L) = (9V - 2V) = 7 \text{ Volts}$

### Calculate Amperage:

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

$$R = 7V / 0.02A$$

$$R = 350 \Omega$$

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

