Introduction to Arduino & ESP8266

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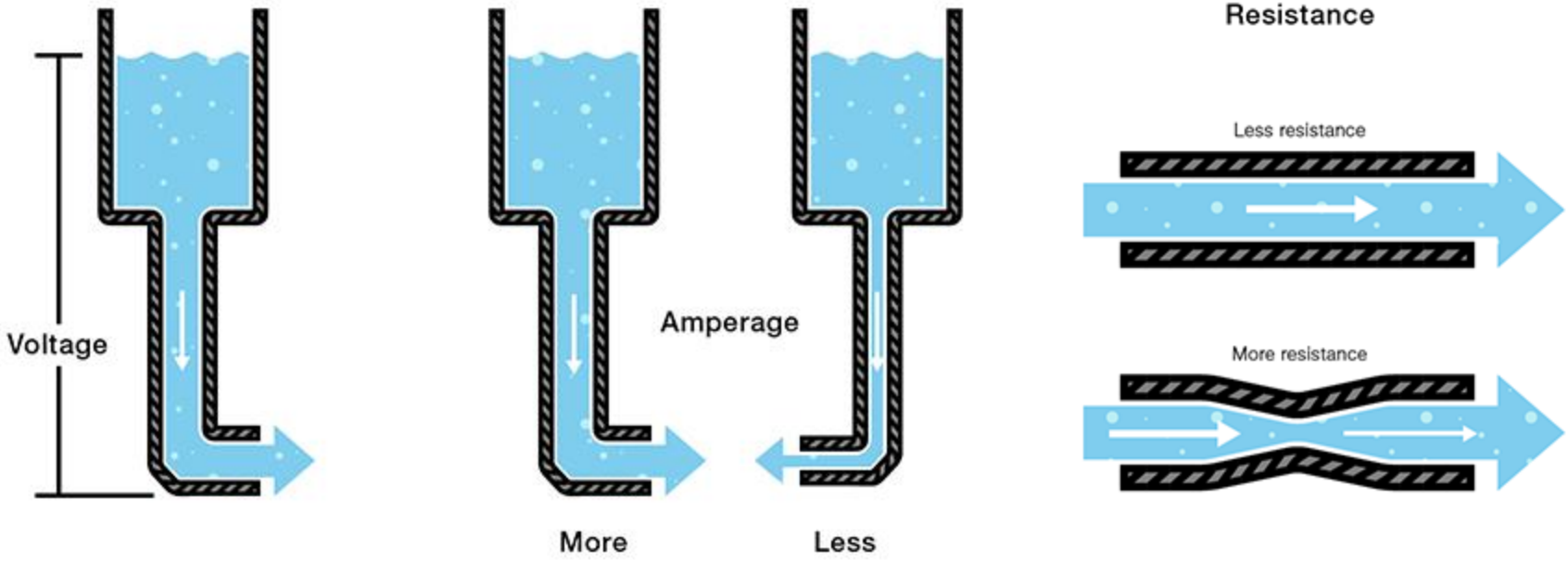
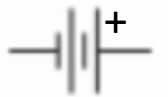
Video Tutorial [16 minutes]

- https://www.youtube.com/watch?v=nL34zDTPkcs&feature=youtu.be
- Also see other tutorials

Basic Electronic Concepts



Basic Electronics

- Voltage or Potential measured in Volts [V] 
- Current (flow on energy) measured in Amperes [I]
- Resistance (restrict flow) measured in Ohms [Ω] 
- Ohm's Law

  Voltage = Current * Resistance $V = I * R$

  Rewritten $I = V / R$ -or- $R = V / I$
- Power (P measured in Watts)

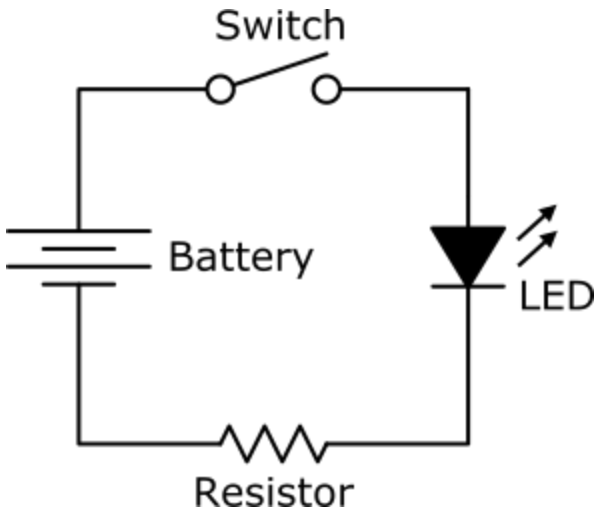
  $P = V * I$ or $P = (I * R) * I = I^2R$

  In electronics, power is converted to heat

Maximum Voltages & Currents

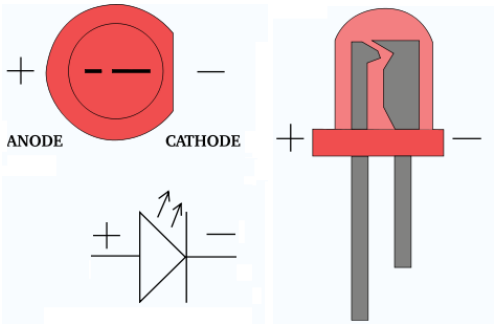
- Arduino
  - 0 to 5v (+ 0.5v)
  - 40 mA (1 milliAmp = 0.001 Amp) [in or out]
- ESP8266
  - 0 to 3.3v (+0.3)
  - 12 mA per pin [in or out]
- Exceed and a pin or the entire microcontroller can be destroyed!

LEDs Need Resistors!

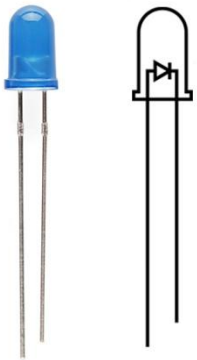


If no resistor LED would quickly burn out – most LED will take max of 25 mA and/or 1.7 to 2.1v (depends on color) before burning out!

Calculate size in Ohms of resistor using Ohms Law R = V / I



Assume supply voltage = 5v & max Led current 25 mA
Need resistor to limit the current by consuming 3v at 25 mA



3v / 0.025a = 120 Ω (minimum)

https://www.kitronik.co.uk/blog/led-resistor-value-calculator/

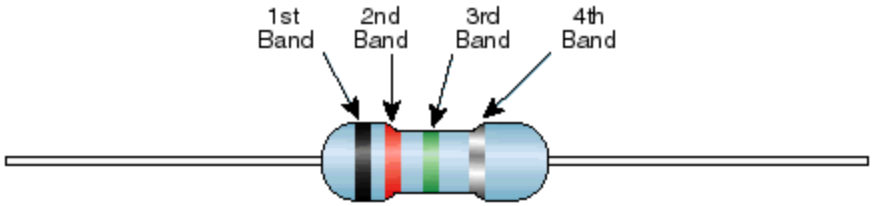
Fixed Resistors

Type & physical size dependant on power to be consumed (as heat!) – typically we will be using ¼ Watt resistor shown on left.

Come in limited number of ohms – chose value close

Color coding specifies ohms value (we will typically see 4 color bands on the resistors that we use)

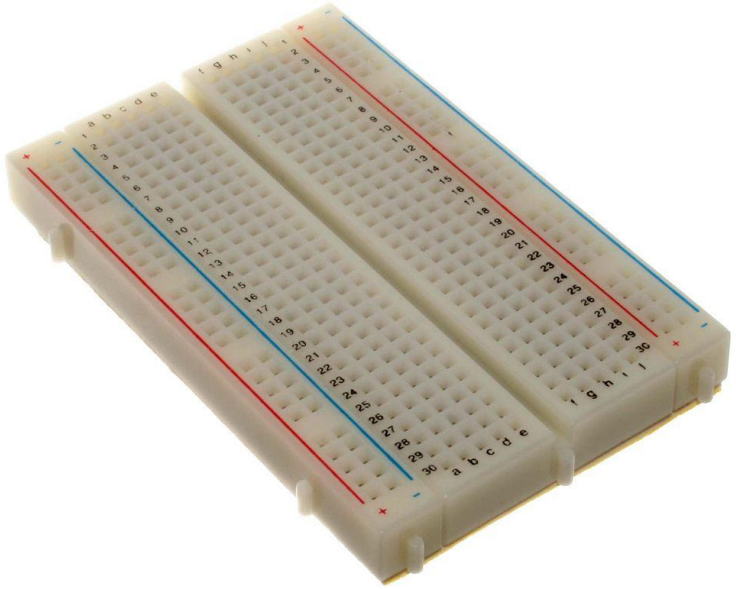
Standard EIA Color Code Table **4 Band**: ±2%, ±5%, and ±10%



Color	1st Band (1st figure)	2nd Band (2nd figure)	3rd Band (multiplier)	4th Band (tolerance)
Black	0	0	10^0	
Brown	1	1	10^1	
Red	2	2	10^2	±2%
Orange	3	3	10^3	
Yellow	4	4	10^4	
Green	5	5	10^5	
Blue	6	6	10^6	
Violet	7	7	10^7	
Gray	8	8	10^8	
White	9	9	10^9	
Gold			10^{-1}	±5%
Silver			10^{-2}	±10%

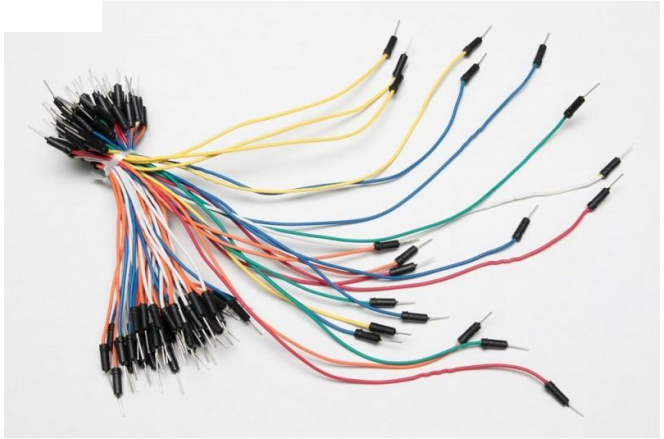
Chart Provided By XICON

Experimenters Breadboard



Come in many sizes
Ravine separates two sides and allows in center allows dual inline packages to be inserted
Typically:
- 2 outer rails on each side for power
  - (red = +, blue = ground)
- 5 cross wise pins are connected

Use bent wire and/or jumper cables to connect pins



Tools I Use All the Time

- Needle nose pliers
- Wire cutters
- Magnifier
- Light
- Soldering iron
- Parts Box
- Small parts envelops

Arduino

- Google Pin Diagram for Specific Item
- Arduino Uno:
  https://i.stack.imgur.com/wKz2l.png
- Arduino IDE
  - Plug in board
  - Select com port
  - Select appropriate board model
  - Select sample program
- Blink program

ESP8266

- To add ESP8266 support to Arduino IDE

http://arduino.esp8266.com/stable/package_esp8266com_index.json

- Various models of Development Boards
  https://frightanic.com/iot/comparison-of-esp8266-nodemcu-development-boards/
- NodeMCU Development Board version 2:
  https://dziadalnfpolx.cloudfront.net/blog/wp-content/uploads/2015/09/esp8266-nodemcu-dev-kit-v2-pins.png
- ESP8266 Blink LED
- ESP8266 with WiFi and Web Server to control LED