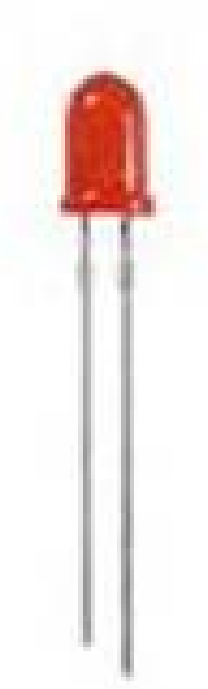
week
03

Sensor 1: Potentiometers

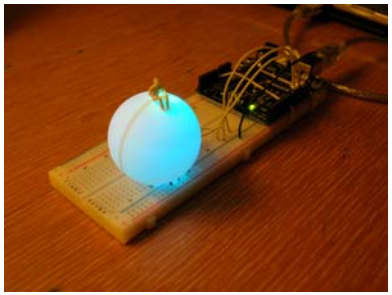
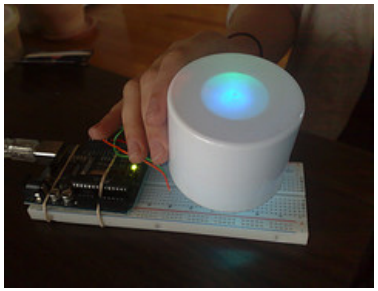
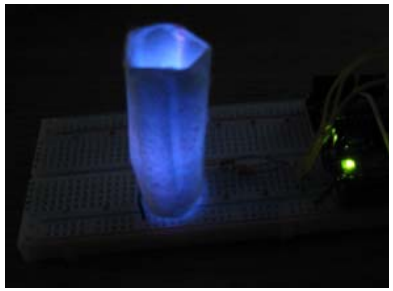
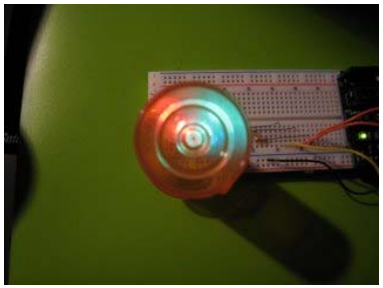
Analog input

Red LED Recall

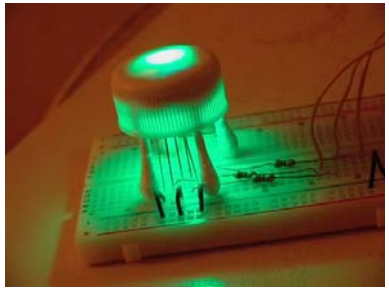
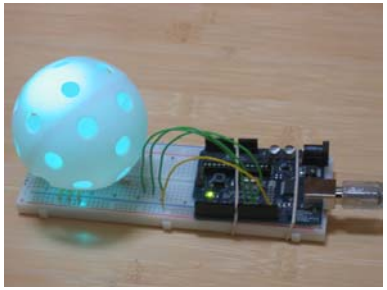
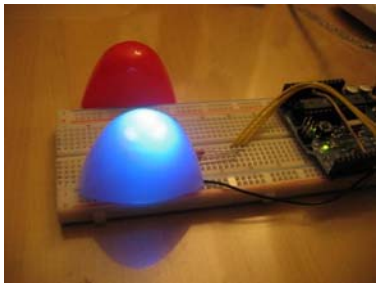


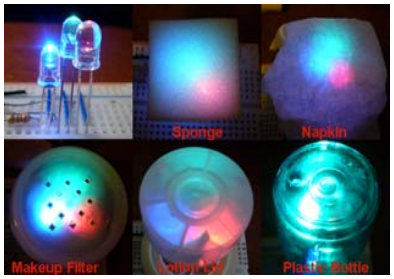
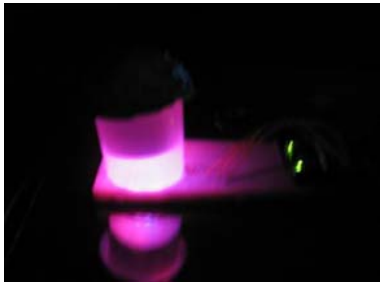
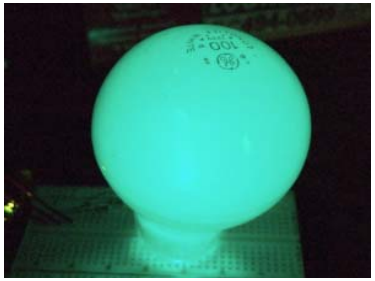
Diffusers

Showcase your diffuser!




Sponge
Napkin
Makeup Filter
Plastic Bottle



Digital vs. Analog

Binary vs. continuous signals

- Binary / Digital = “whether or not”
- Continuous / Analog signal = “how much” or “faster,” “brighter,” etc.

Binary / Digital :

- 0V (LOW) or 5V (HIGH)

Continuous / Analog : e.g.

- 0.095V
- 1.0V
- 4.555V
- etc.

Digitizing Analog Input

Microprocessor cannot deal with analog signal internally, so you digitize it. Afterwards, computer only knows the dashed line so to computer, analog input is “chunky.”

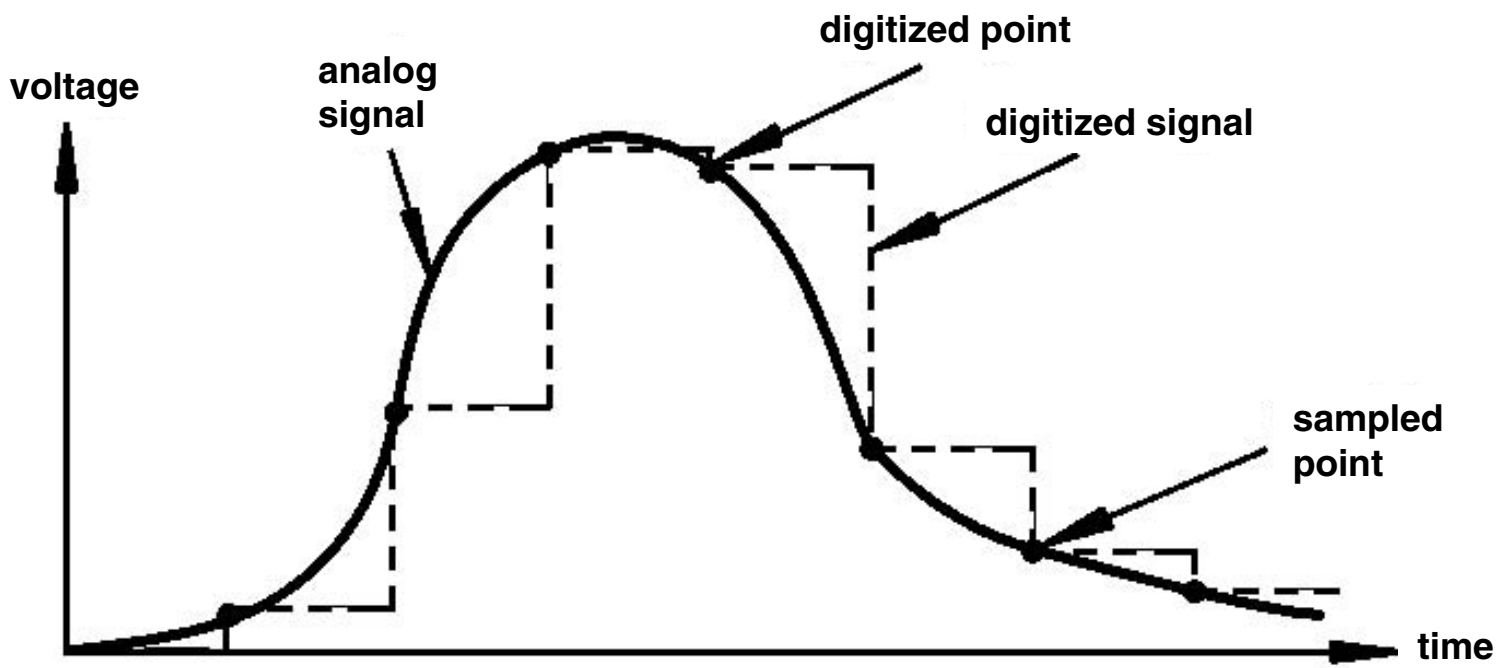
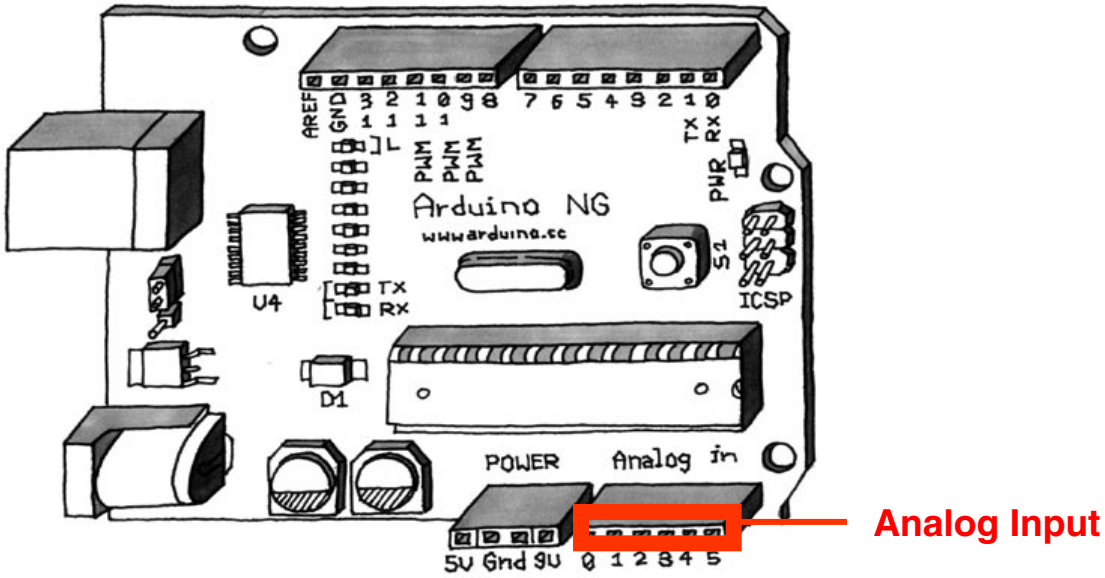


Illustration adapted from Tod Kurt’s Spooky Projects with Arduino

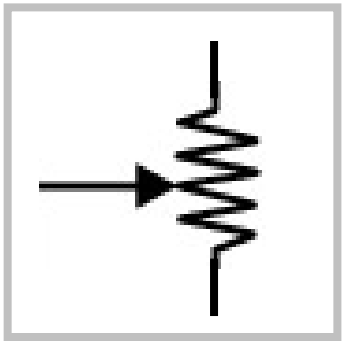
Analog Input on Arduino

- Arduino has 6 ADC (Analog to Digital Converter) inputs
- Reads voltage between 0 to 5 V
- Resolution is 10 bits: $2^{10} = 1024$ states
- 5V/1024 = 4.8mV smallest voltage difference Arduino can measure

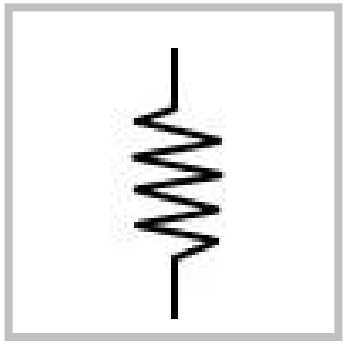


Potentiometers

- Variable resistor (a type of “resistive sensor”)
- Pot for short
- When you need a “ranged” input
- Measures rotational position (knob for volume, light dimmer, etc.)



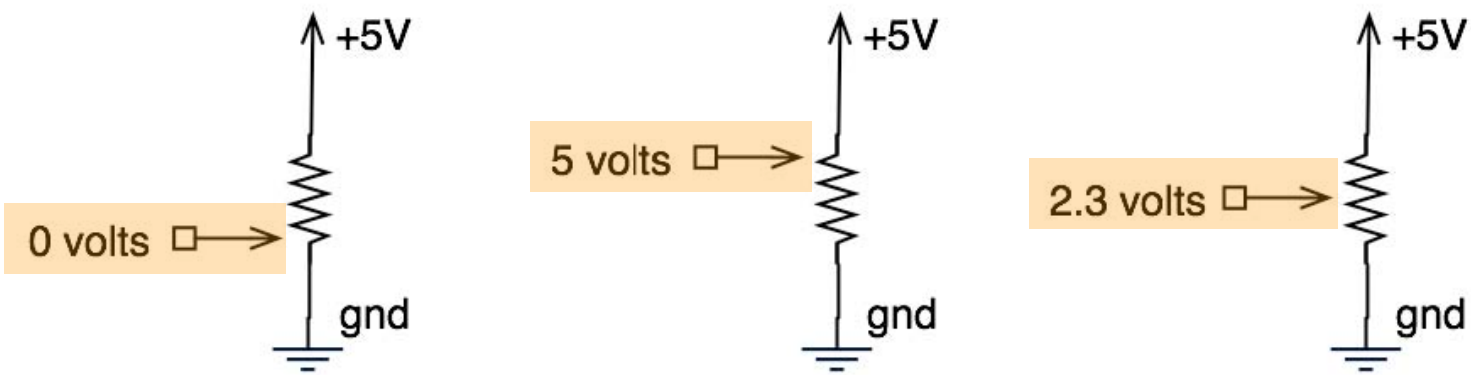
pot



resistor

Potentiometers

- It's like a faucet (if current is analog to water flow)
- Like any other resistor, but you can vary the amount of resistance
- Generally used for making a varying voltage (remember, Arduino measures voltage differences, not resistance differences)



turned anti-clockwise

turned clockwise

somewhere in the middle

Illustration adapted from Tod Kurt's Spooky Projects with Arduino

In Class Exercise

Controlling LEDs with potentiometers

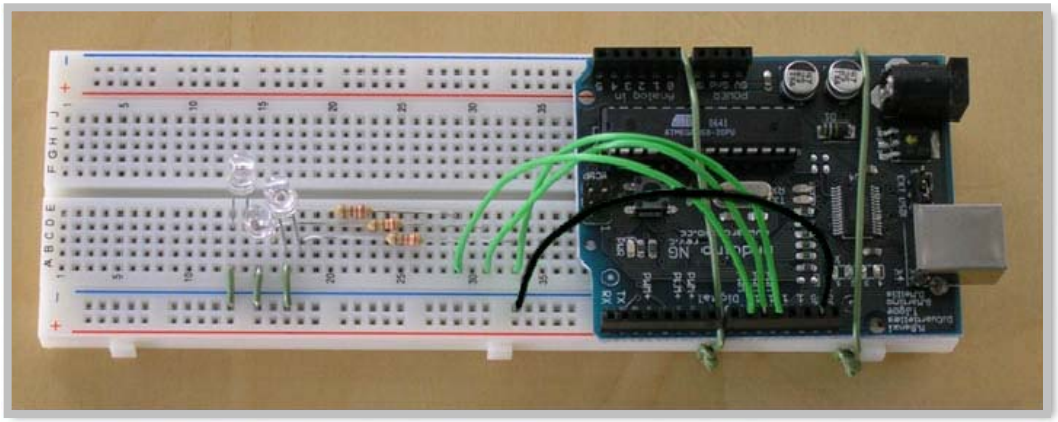
Control your color mixer with multiple pots

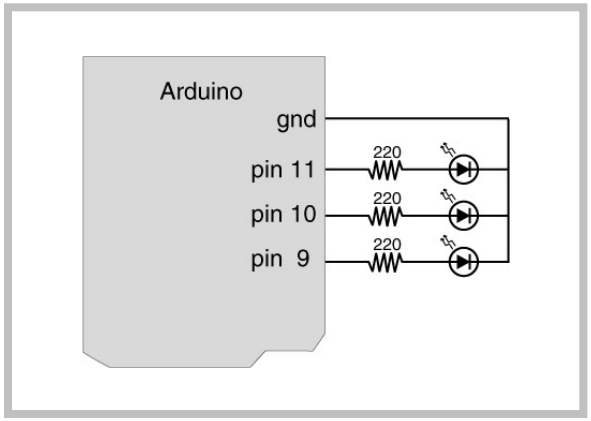
In Class Exercise

1. RGB LED Fade
2. Strip wires
3. Solder wires to pot
4. Control one LED
5. Control LED(s) with multiple pots

Circuit with 3 LEDs

Plug in the three LEDs, red, green, and blue, and make different colors



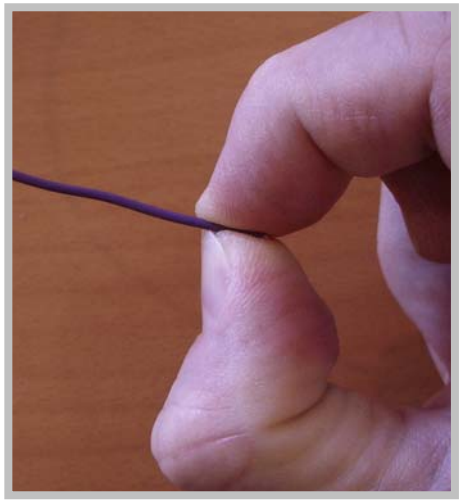


In Class Exercise

1. RGB LED Fade
2. **Strip wires**
3. Solder wires to pot
4. Control one LED
5. Control LED(s) with multiple pots

Strip the Wires

Take 6 wires (2 red, 2 yellow, and 2 black) and strip off about ¼” of insulation at both ends of each wire.



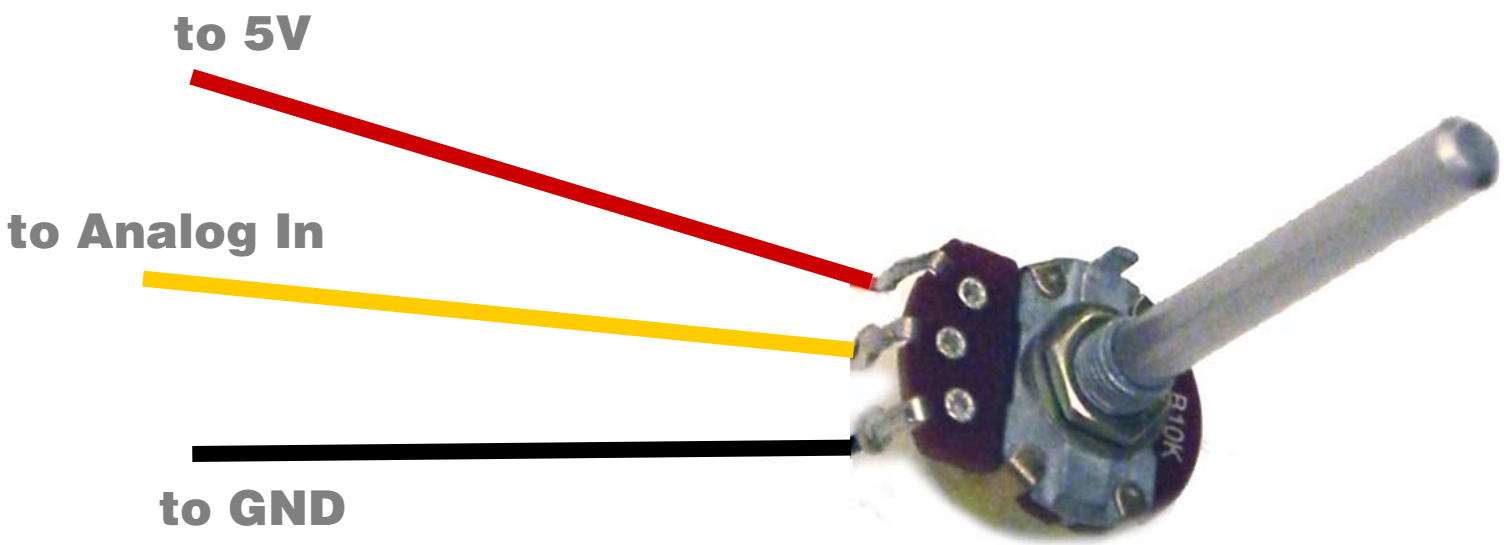
Photos from Tod Kurt’s Spooky Projects with Arduino

In Class Exercise

1. RGB LED Fade
2. Strip wires
3. **Solder wires to pot**
4. Control one LED
5. Control LED(s) with multiple pots

Potentiometers

Solder the wires to your pots. Solder the wires for two pots.

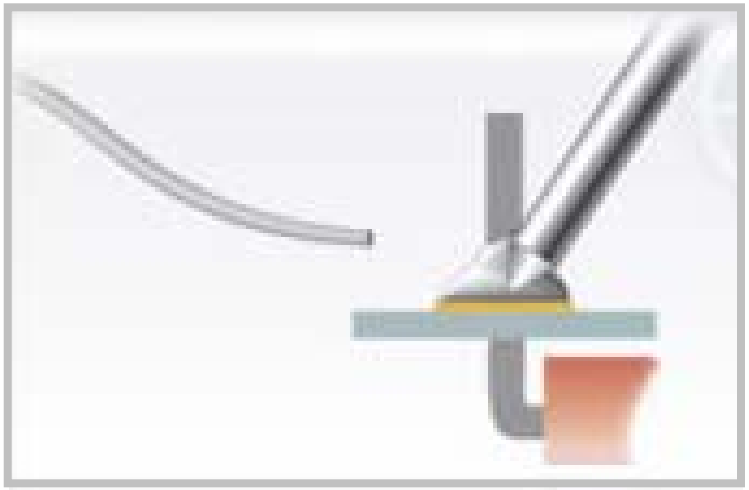


Soldering

Heating the joint, not the solder. Use lead-less solder.

1 Heat the joint, not the solder

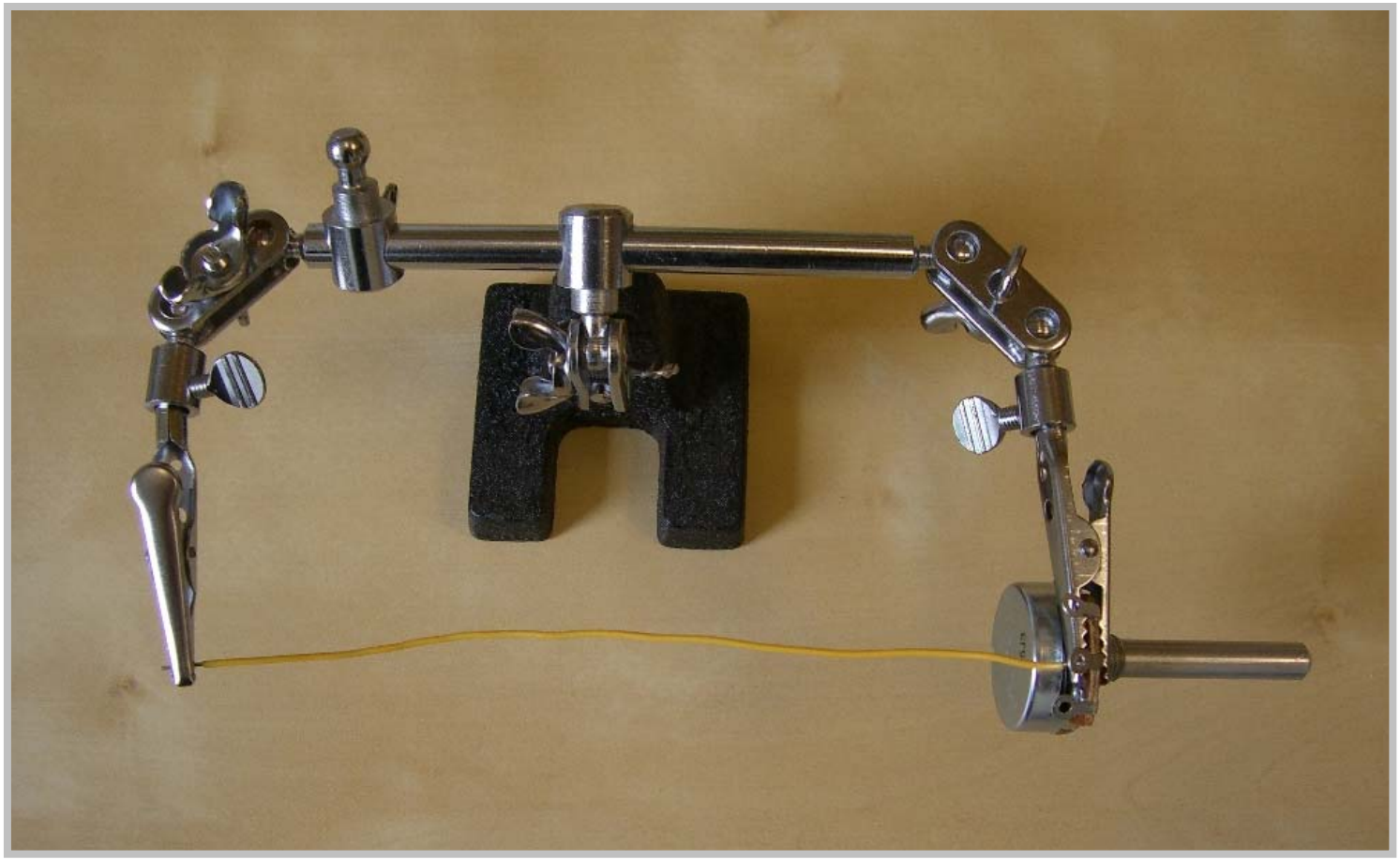
2 Melt the solder



3 Release the solder

Illustrations from http://www.chaneyelectronics.com/training/soldering.htm

Soldering: Helping Hands



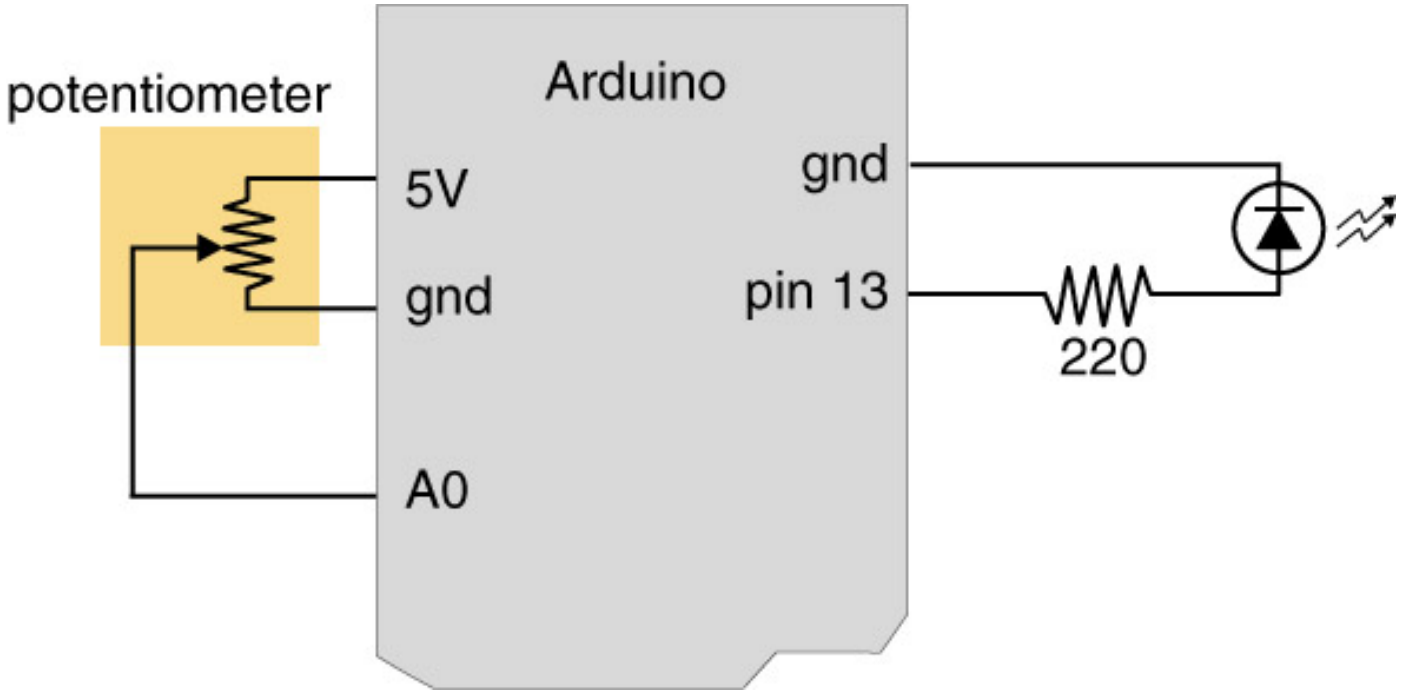
Soldering: Safety

Please wear safety goggles! It's stylish!

In Class Exercise

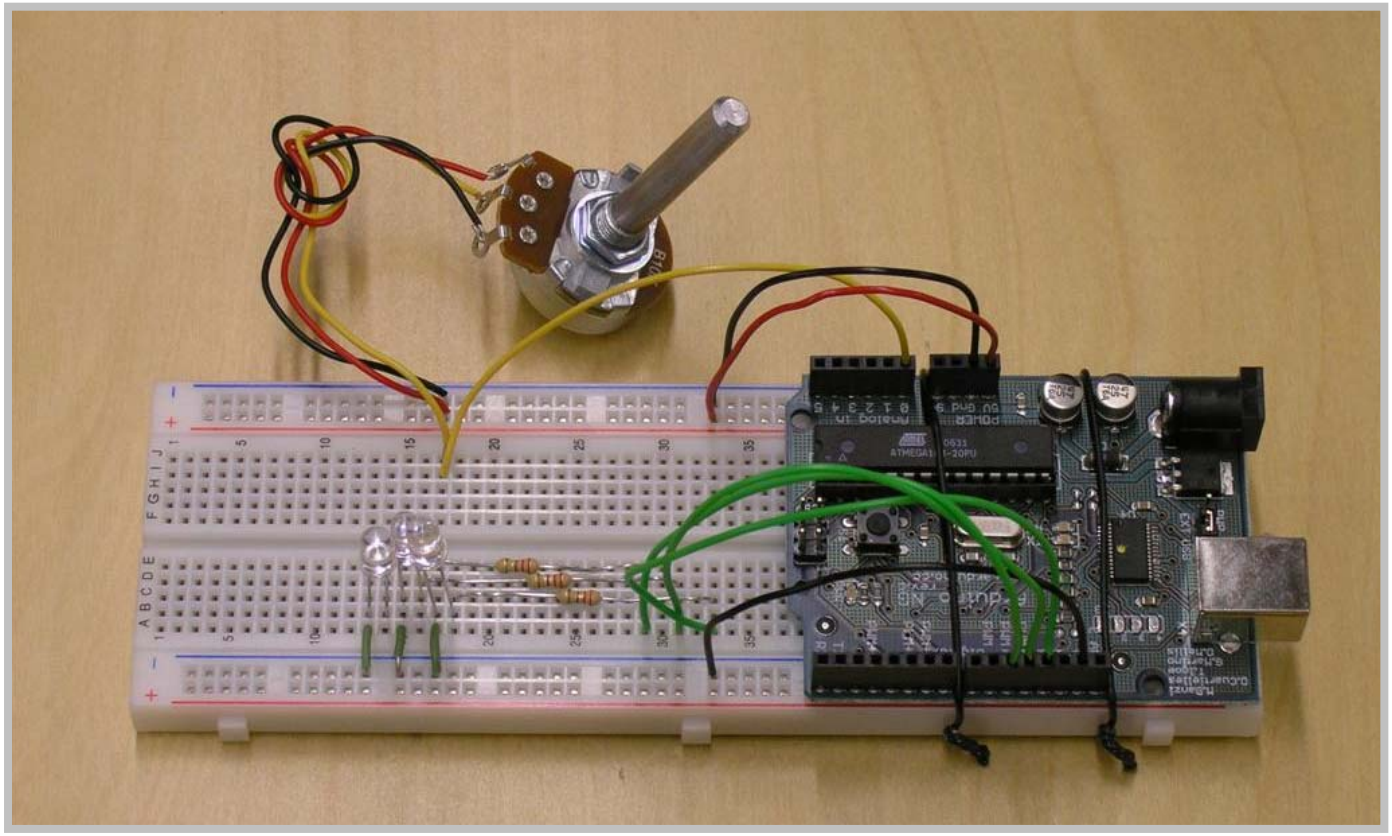
1. RGB LED Fade
2. Strip wires
3. Solder wires to pot
4. **Control one LED**
5. Control LED(s) with multiple pots

Controlling your LED with a Potentiometer



Controlling an LED with a Pot

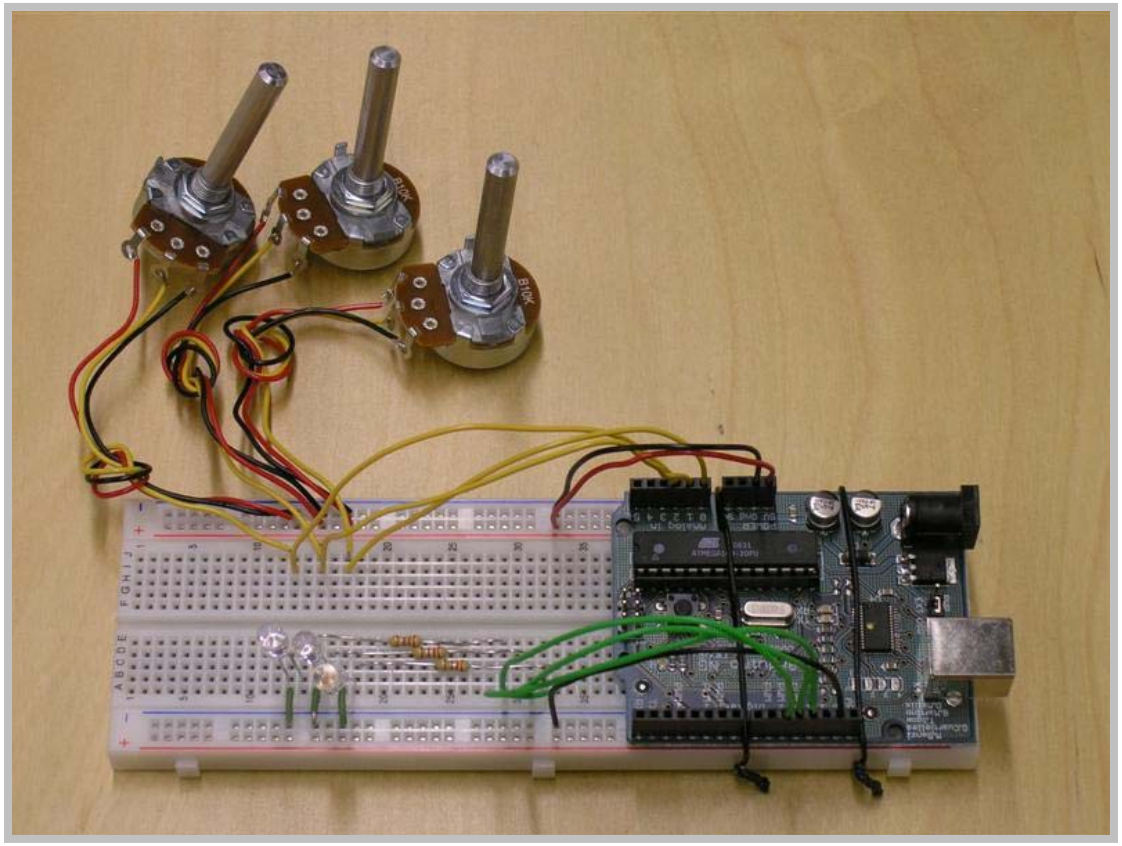
Make one LED to dim and blink at different rate



In Class Exercise

1. RGB LED Fade
2. Strip wires
3. Solder wires to pot
4. Control one LED
5. **Control LED(s) with multiple pots**

Controlling multiple LEDs with multiple Pots



Option 1:
control one LED with two pots

Option 2:
control three LEDs with three pots

Soldering

Be careful:
It could be 1000 degrees!

Next Thursday

Sensor 2: Force sensitive resistors and photocells

Arduino as an interface board: Processing

Read Intro to Processing at **processing.org**

Thanks!