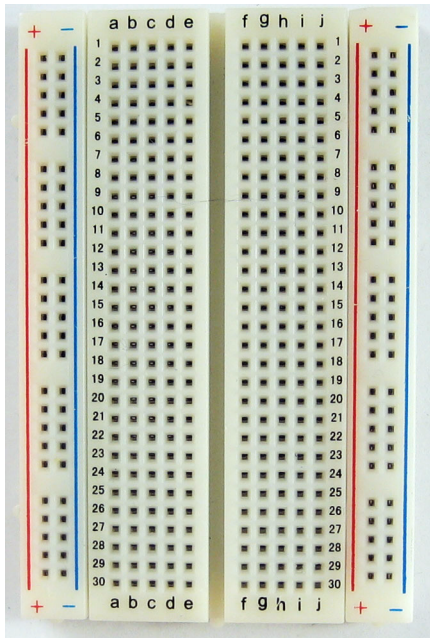


## Class 3. Setting up a Breadboard, and making a LIGHTBOX

1. Review (LED Blink)
2. Understanding a Breadboard
3. Make LED blink on the breadboard
4. Make multiple LED's blink
5. Make a color mixing LIGHTBOX

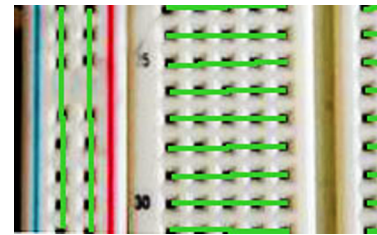


The breadboard is basically a chunk of plastic with a bunch of holes in it. But there is something special going on:

There is electrical conductivity. Basically this means that even though you can't see it, if you poked inside, there are metal strips that connect the ROWS and the COLUMNS together. LIKE THIS:



here's a CLOSE UP



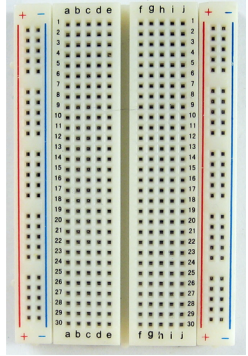
columns

rows

NOW, let's try to get the LED to BLINK, but this time, on the breadboard...

# What we will need to set up the breadboard for a blinking LED

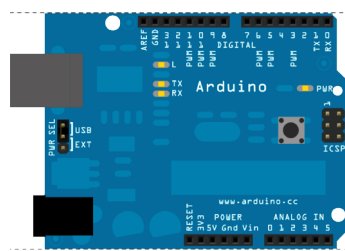
1. Breadboard



2. LED



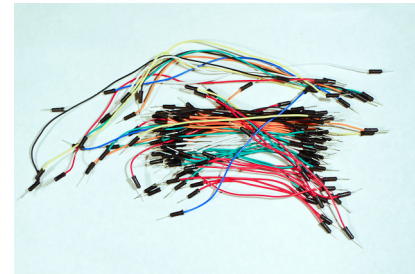
3. Arduino



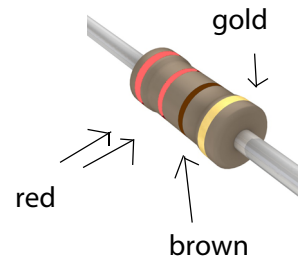
4. USB

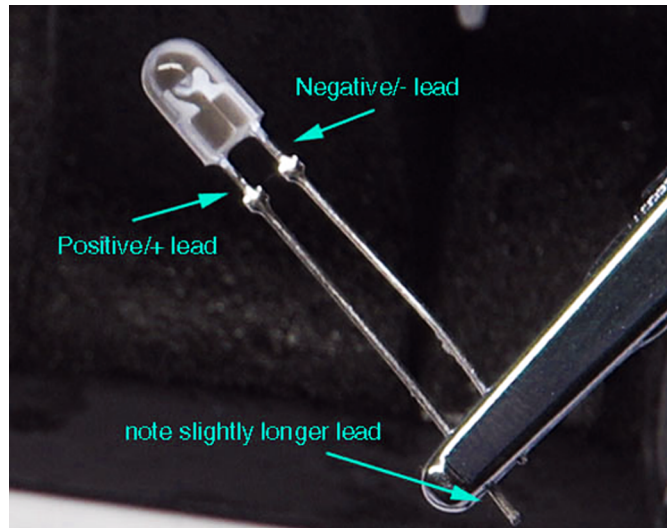


5. wires



6. 1 220 ohm resistor





LED = Light Emitting Diode

LED's WILL NOT work if placed backwards, so if your LED doesn't light up when you think it will, try reversing it!



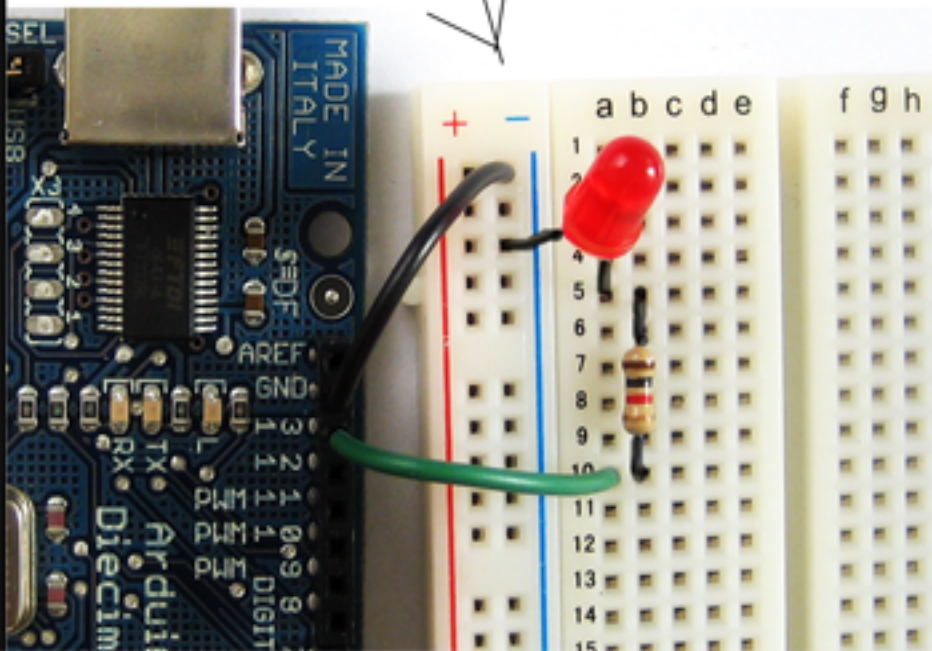
## Step 2. Setup the Breadboard

Connect a BLACK wire from a ground ("GND") pin on Arduino to the ground column on the breadboard (the one marked in BLUE, with the minus "-" sign)

Connect a BLUE or GREEN wire from pin 13 to any row on the breadboard

Connect a resistor from one row to the LONG leg of the LED

Connect the LED from the RESISTOR to GROUND (the blue striped column on the breadboard)



NOTE: RESISTORS can be connected EITHER way (unlike LED's)

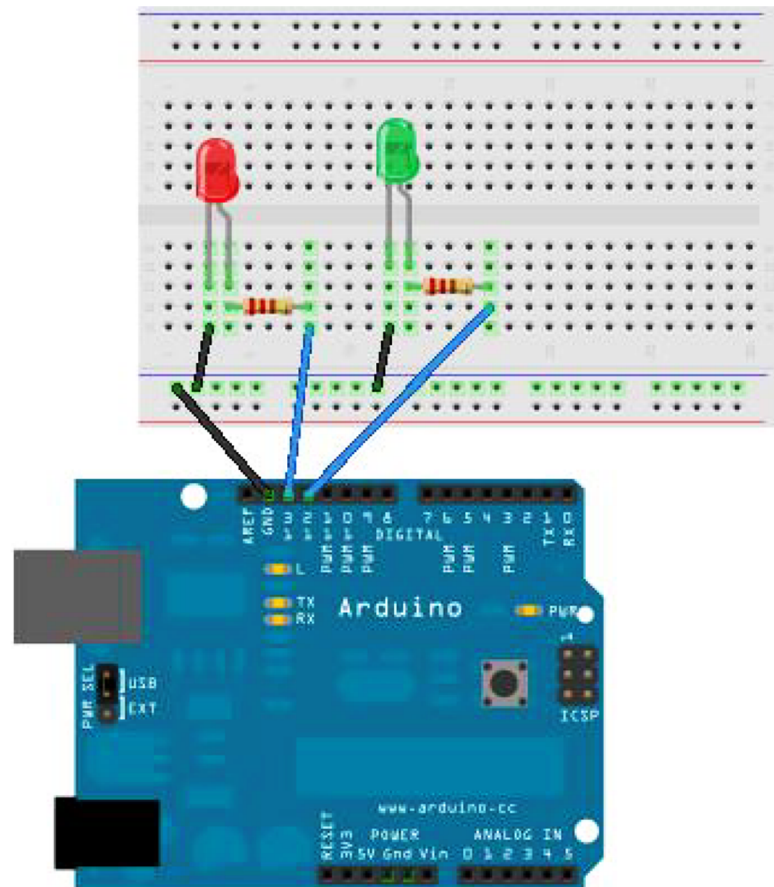
The color of the wires DOES NOT matter. It just helps to be neat.

# Step 3. VERIFY and UPLOAD! (remember this!)

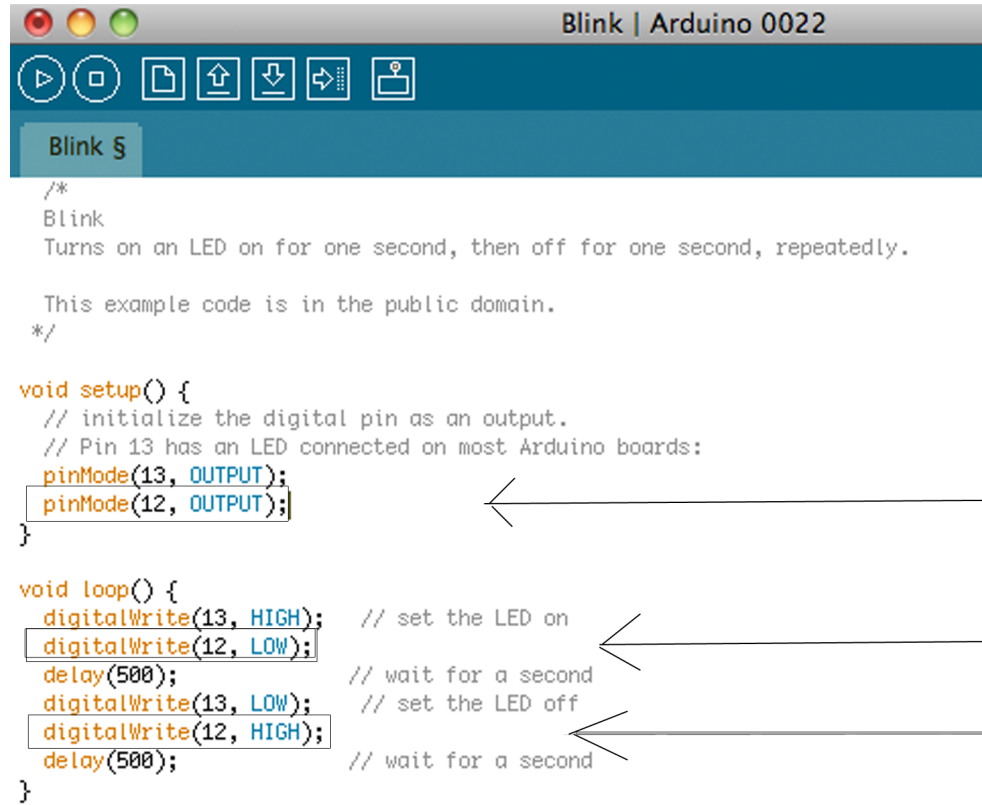


# Step 4. Let's mix colors! Lighting up MULTIPLE LEDs

A. Set up the breadboard:



## B. MODIFY our BLINK SKETCH



```
/*
Blink
Turns on an LED on for one second, then off for one second, repeatedly.

This example code is in the public domain.
*/

void setup() {
  // initialize the digital pin as an output.
  // Pin 13 has an LED connected on most Arduino boards:
  pinMode(13, OUTPUT);
  pinMode(12, OUTPUT);
}

void loop() {
  digitalWrite(13, HIGH); // set the LED on
  digitalWrite(12, LOW);
  delay(500); // wait for a second
  digitalWrite(13, LOW); // set the LED off
  digitalWrite(12, HIGH);
  delay(500); // wait for a second
}
```

Add these three lines:

pinMode(12, OUTPUT);

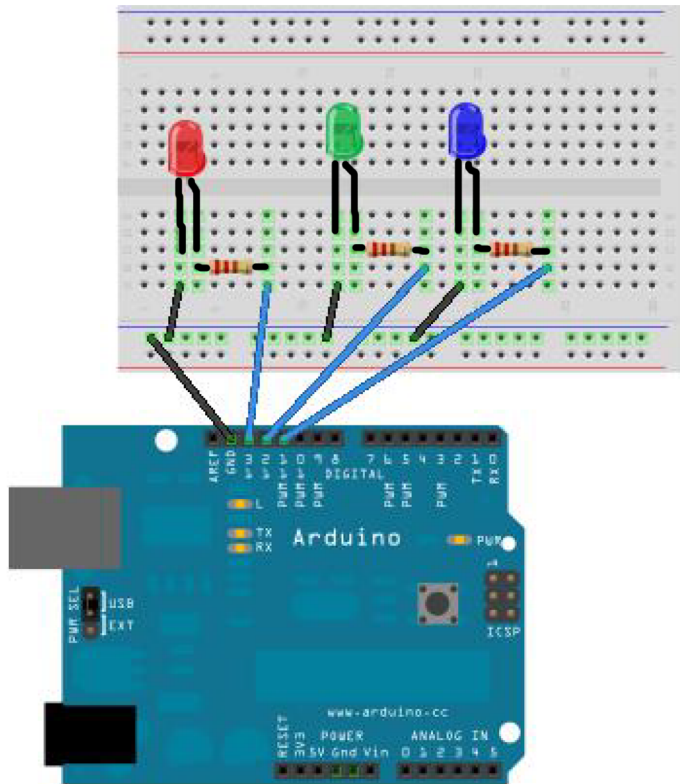
digitalWrite(12, LOW);

digitalWrite(12, HIGH);

NOTE: all text that looks like:  
*//this is just a note*  
is just notes, it isn't part of the code

VERIFY and UPLOAD!

Prepare the breadboard:



Add a third LED to pin 11

Make the following modifications to our Blink sketch

```

Blink | Arduino 0022
Blink 5
/*
 * Blink
 * Turns on an LED on for one second, then off for one second, repeatedly.
 *
 * This example code is in the public domain.
 */

void setup() {
  // initialize the digital pin as an output.
  // Pin 13 has an LED connected on most Arduino boards:
  pinMode(13, OUTPUT);
  pinMode(12, OUTPUT);
  pinMode(11, OUTPUT);
}

void loop() {
  digitalWrite(13, HIGH); // set the LED on
  digitalWrite(12, LOW); // set the LED on
  digitalWrite(11, LOW); // set the LED on
  delay(500); // wait for a second
  digitalWrite(13, LOW); // set the LED off
  digitalWrite(12, HIGH); // set the LED on
  digitalWrite(11, HIGH); // set the LED on
  delay(500); // wait for a second
}

```

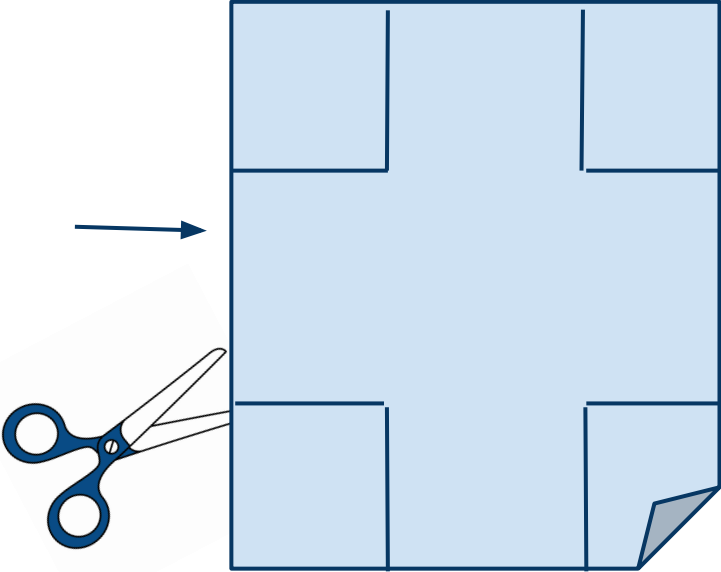
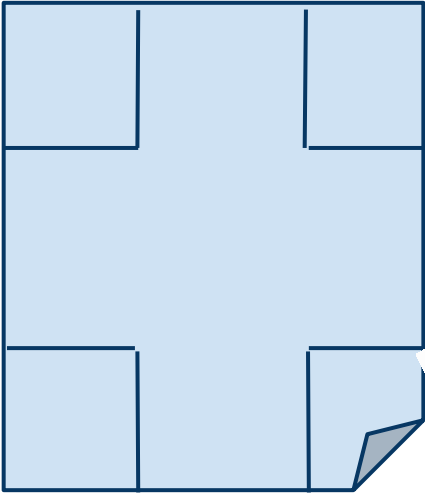
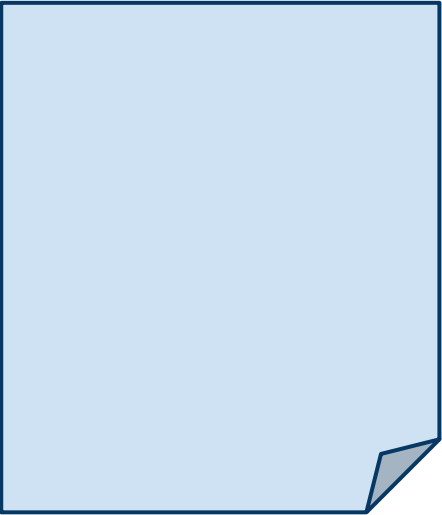
VERIFY and UPLOAD.

Step 6. Making a color-mixing LIGHTBOX

A. Start with a piece of paper.

B. Draw squares like this in the four corners.

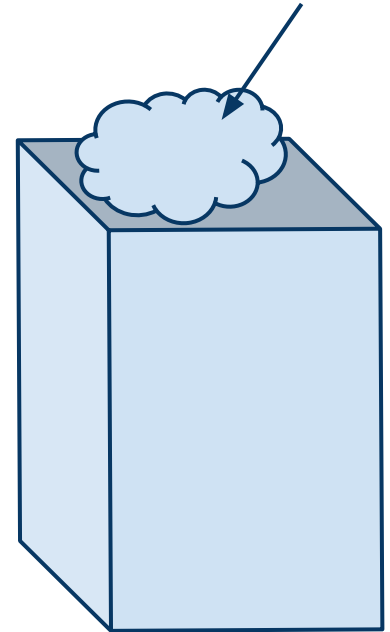
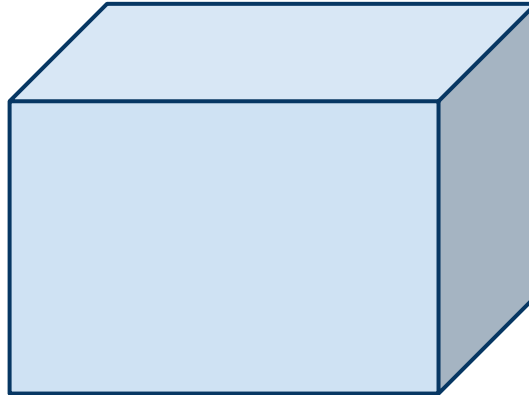
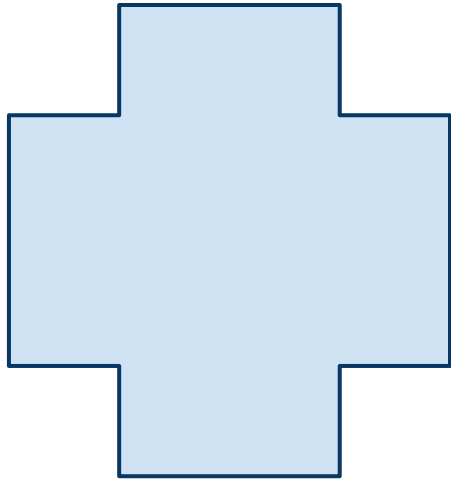
C. Cut along the lines.



D. So you have this.

E. Now fold the sides in...

stuff it with tissue for a cool effect



...so you have something like a tissue box

And place it over your LED's!

Some cool websites:

[hackaday.com](http://hackaday.com) - super neat projects using arduino

[adafruit.com/tutorials](http://adafruit.com/tutorials) - super helpful tutorials about getting started with arduino

<http://blog.makezine.com/video/> - Make Magazine - cool videos and tutorials

Arduino.cc - TONS of stuff here, from tutorials, to ideas...

Instructables.com