Breadboards make it easy to assemble electronic circuits without soldering
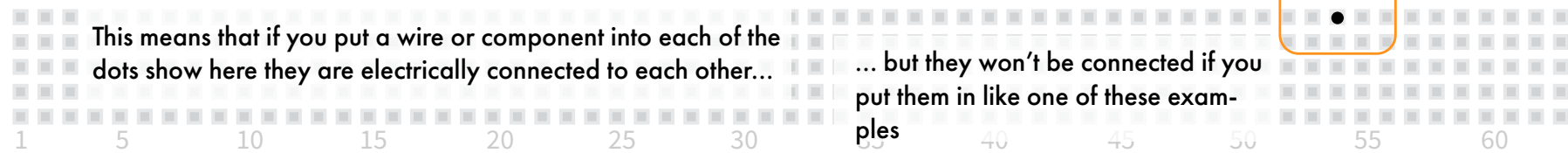
The holes on a breadboard are connected as show with the colored lines.
The vertical strips on either side of the central gap are connected in groups of five.
The horizontal red and blue "bus" lines are connected all the way across the board.

1   5   10   15   20   25

Connected

Not

Connected   Connected   Connected

Not

Not

⌣ Wire

Not

This means that if you put a wire or component into each of the dots show here they are electrically connected to each other...

... but they won't be connected if you put them in like one of these examples

1   5   10   15   20   25   30   35   40   45   50   55   60

Breadboard setup #1 - Your first circuit

Here we're just using the Teensy as a power source. The LED will turn on when the button is pressed. [Here's](#) a simulation of the circuit.

Connect the 3.3V pin to the red line at the top and the ground pin to the blue line at the bottom.

Don't connect the 5V pin to anything. It can damage the other pins.

Connect the top and bottom blue and red lines together. This will allow us to easily plug into power anywhere on the board.

1k Resistor

LED

Small wire
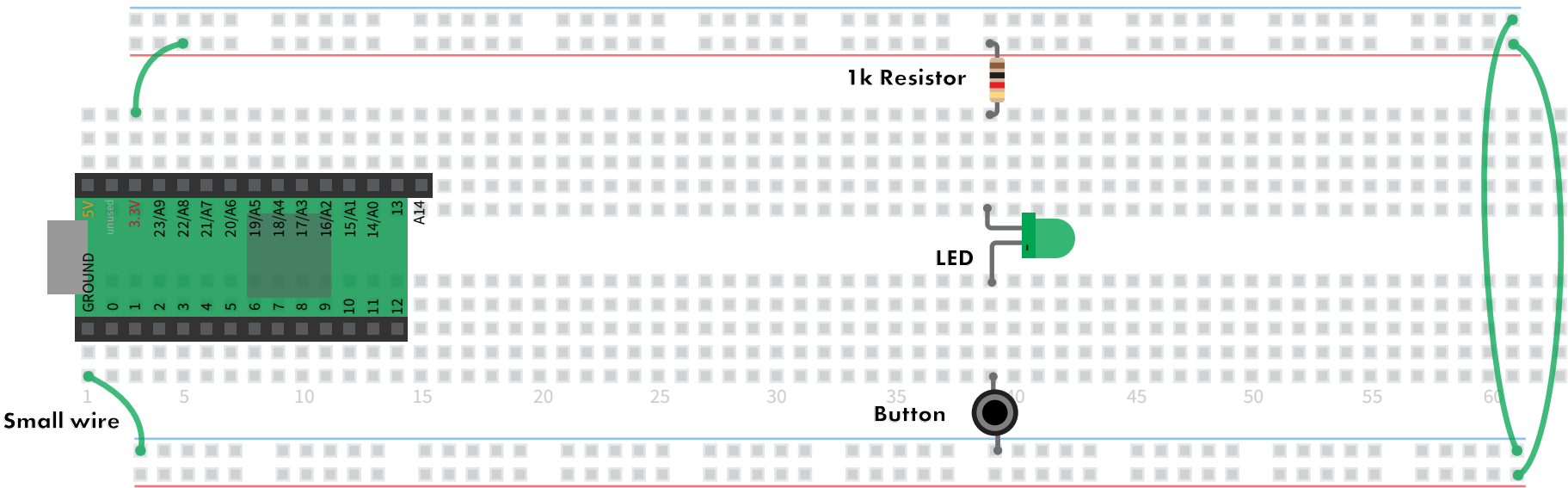
Button

Resistors and buttons are not polar, meaning the can be installed in either direction. They restrict the flow of electricity. The LEDs can only handle so much voltage so the resistors lower it coming out of the Teensy.

LEDs are polar. All diodes allow electricity to flow in one direction but not another. Install them so their short leg is connected to ground, aka the blue horizontal line.

Breadboard setup #2 - Blinking

Move the button, resistor, and LED and add another resistor and LED. Now we can control the lights with code.

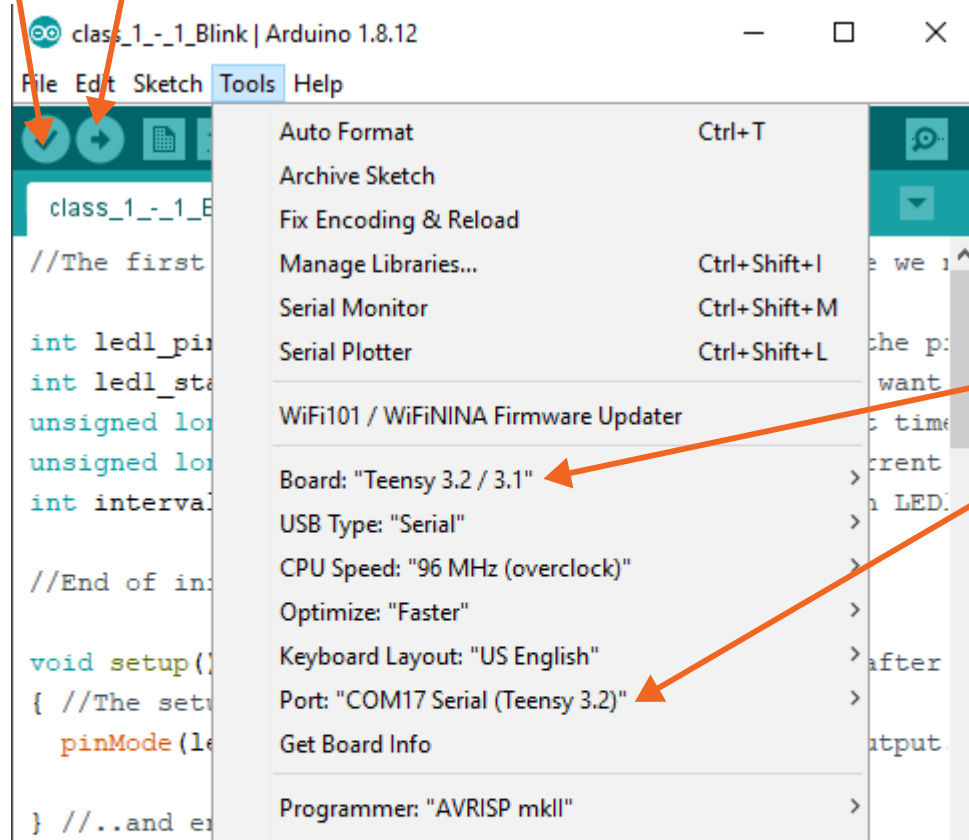1k Resistors

Button

LEDs
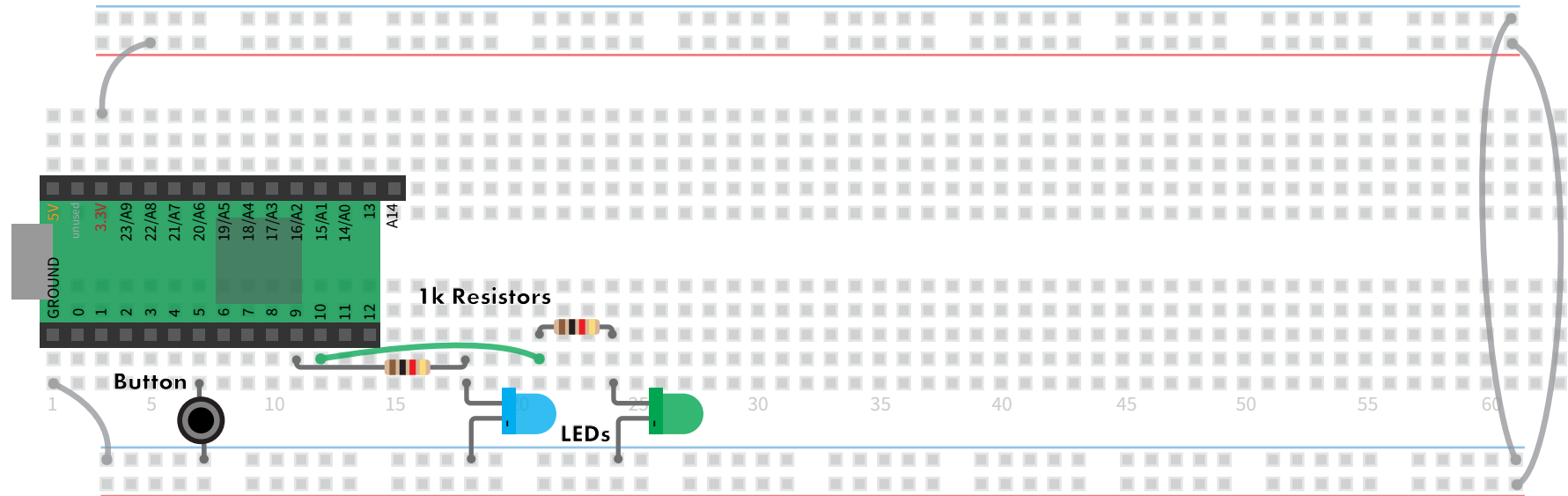
Grey wires are already installed

The Arduino IDE is how we'll code and communicate with the teensy

Verify
Check that the code doesn't have any errors and comile but don't upload it.

Upload
Compile the code and put it on your device

Before you can upload your code you must select the teensy board and the port it is connected to

Go to Tools and select Teensy 3.2/3.1 under board.

Plug your device in to USB and select whatever port shows "Teensy" on it.

You don't need to worry about the rest for now.

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Breadboard setup #3 - Analog reading
Lets add some potentiometers to control the lights

The potentiometer assembly connects one side of the pot to 3.3V and the other to ground.
Wire the middle pins to the analog read pins.
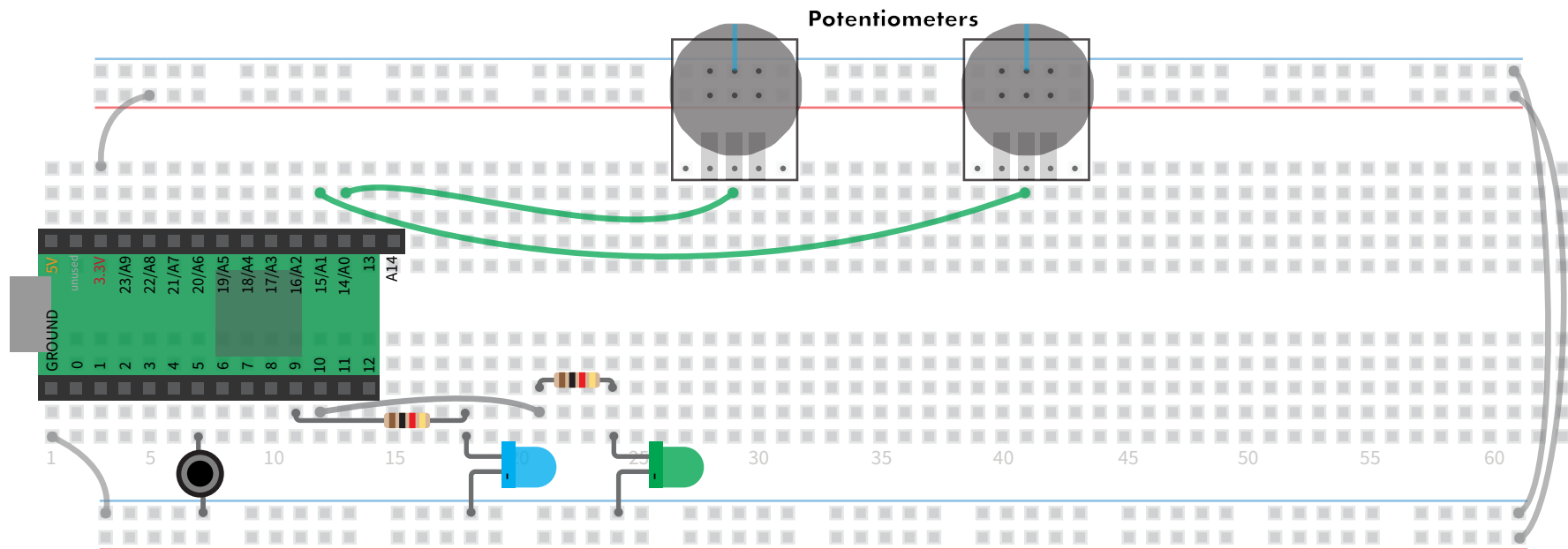
Potentiometers

A potentiometer is a fixed resistor with a tap you can move, allowing you to adjust the resistance of the middle pin with the outer pins. These resistances stay in proportion to each other. If the total resistance is 10k Ohms and the pot is right in the middle it will be 5k Ohms between the middle and left pin and 5k Ohms between the middle and left pin.

For most of the course we'll be using them as voltage dividers.
With one sine of the pot connected to 3.3 Volts and the other connected to ground, aka 0 Volts, the middle pin will output an adjustable voltage which the Teensy can read with its analog to digital converter and give you a value to use in your code.

Here you can see a diagram of a pot in two different positions. On the left it's closer to the top pin. The ratio is 1/4 of the total resistance between the top and middle pin so it's 3/4 for the middle and bottom so the output is about 3.3 * 3/4 = 2.54 (it's rounding in the simulation).
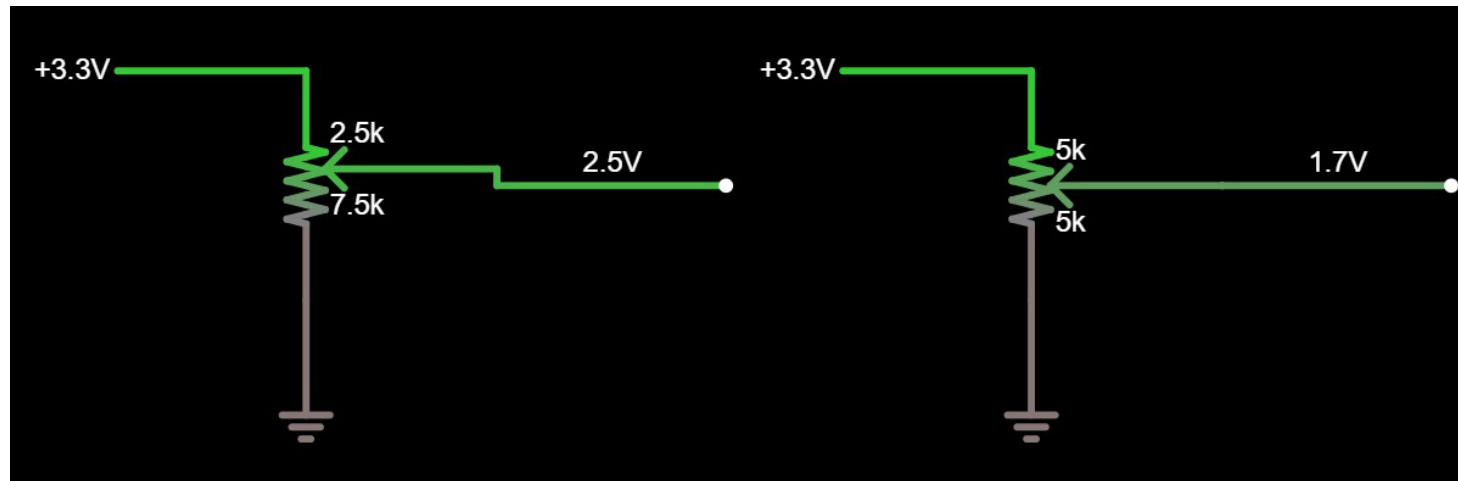
Simulation link

Later on we'll use a differnt pot as a volume control which is really the same setup except the 3.3V pin becomes the audio in pin, allowing you to mix between the audio and ground to attenuate the sound.

Arduino is a platform.
A programming environment, hardware, software, and a community.

We program devices compatible with the platform in the C language with lots of Arduino specific code libraries.

There is no operating system or anything like that. The code you upload is all there is.

The Teensy 3.2 device we use is based on a microprocessor chip that already existed. Paul Stoffregen of PJRC decided to make work with the Arduino platform and it's become one of the main Arduino devices people use due to its price, formfactor, and power. The original Arduino UNO is still a useful device though. It just isn't near as powerful.