What Is Electricity?

Electricity flows in the path of least resistance

From positive terminal on battery to negative*

From 5V out from the Arduino to ground

Voltage (volts) = flow

Voltage flows from a power supply into a device

Current (amps) = suck

Current is pulled from the power supply by the device

Resistance (ohms) = restriction

Resistance changes the amount of voltage

Voltage from your supply should never be more than your device can handle

USB sends out 5 volts
Your Arduino runs on 5 volts*
Happy Arduino!

The wall outlet sends out 120 volts
Arduino = smoke and sadness

Less voltage is sometimes ok (ex: it will make a motor turn slower)
Too much will damage your device but not your supply

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Current needs of your device should never be more than your supply can provide

Your Arduino pulls a max of ~500mA
USB is able to provide ~500mA
Happy USB!

A big motor attached to your Arduino pulls 2A
Sad Arduino and sad USB!

More current capacity from your supply is fine
Too little available current will damage your supply

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Resistance changes the amount of voltage

Analog sensors are (mostly) all resistive

Made of materials that change resistance under different conditions

Ex: light sensor lets more electricity through the more light there is

The analog pins measure the voltage, which gives us a reading!

Sending 5V directly back into ground is bad because it creates infinite current!

(aka a short circuit)

This creates heat, smoke, and other bad things

Direct current (DC)

Continuous current at the same level
What nearly all consumer electronics run on

Alternating current (AC)

Sinewave where current swings pos/neg
(Rate of 50Hz or 60Hz)
What comes out of your wall socket
And runs things like fridges and blenders

Electricity = ~~Flow~~ Dangerous

(or, at least, it can be)

Never touch two wires together

Avoid wiring a circuit with your Arduino plugged in

Heatshrink or electrical tape!

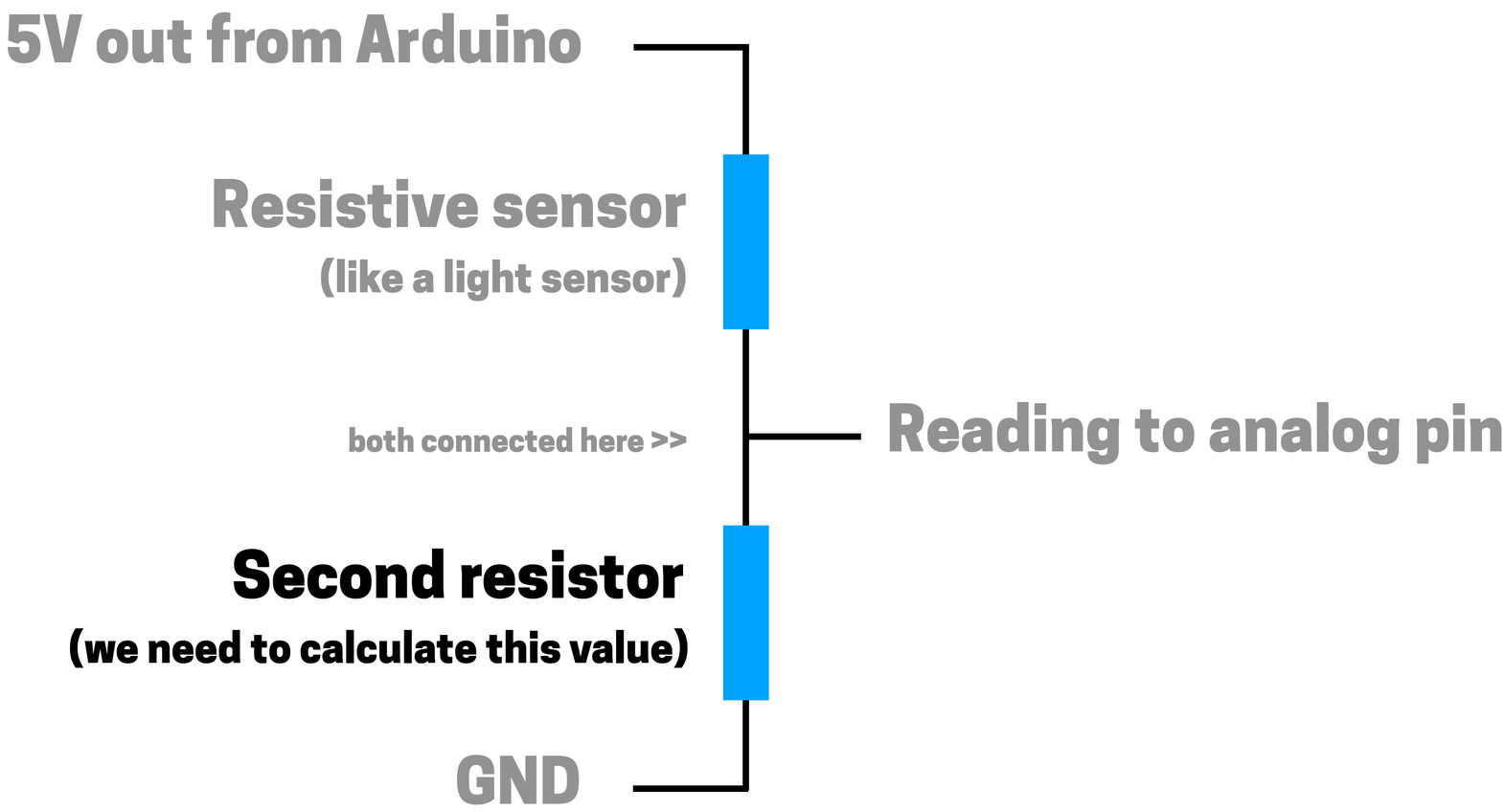
Avoid anything that plugs into the wall

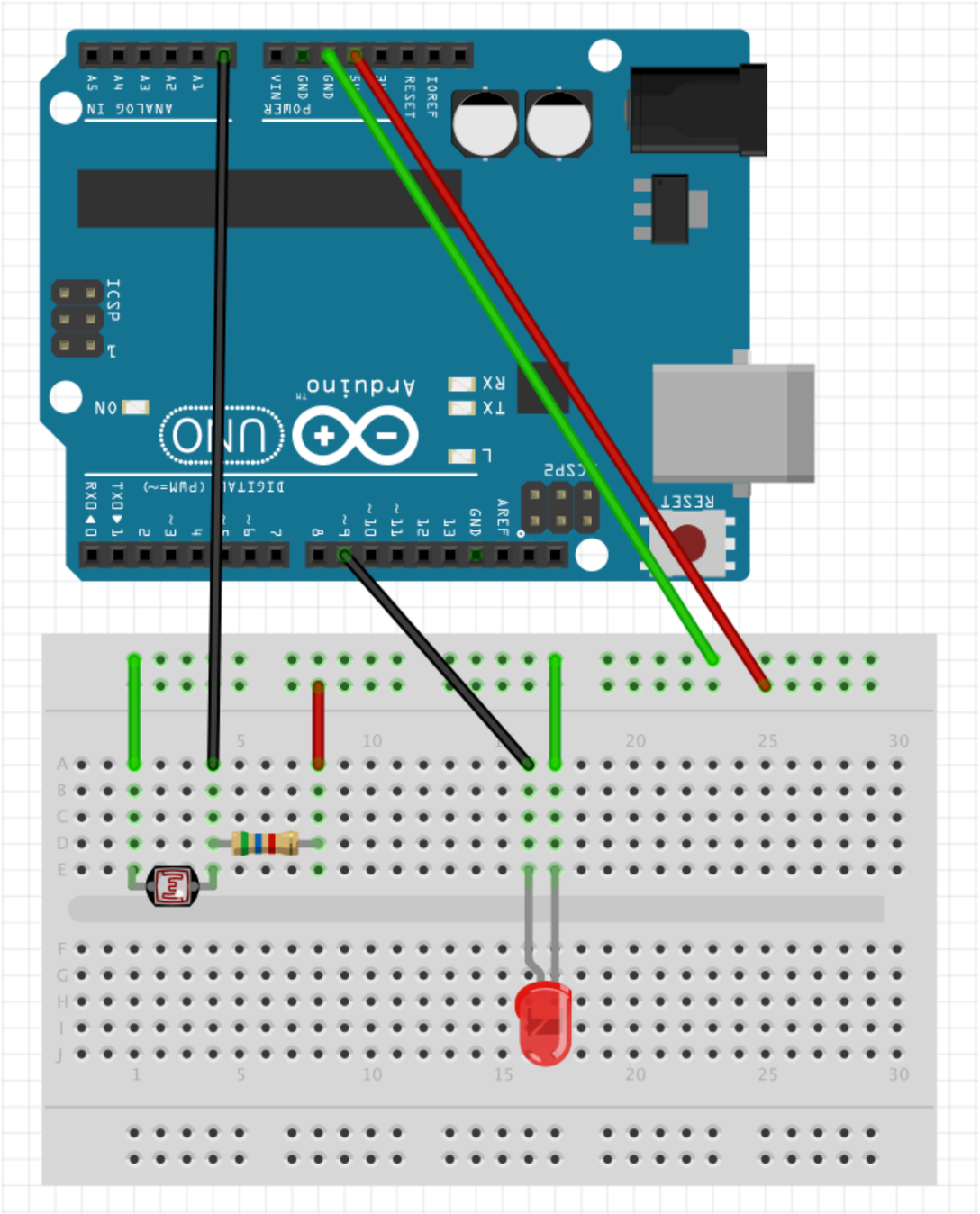
Voltage Divider

Review: we don’t want all current flowing back into GND

The electricity needs to go somewhere

A “voltage divider” circuit lets us read other analog sensors


5V out from Arduino
Resistive sensor
(like a light sensor)
both connected here >>
Reading to analog pin
Second resistor
(we need to calculate this value)
GND


ANALOG IN
POWER
IOREF
RESET
ICSP
ON
Arduino
UNO
TX
RX
L
RESET
AREF
GND
A
B
C
D
E
F
G
H
I
J
1
5
10
15
20
25
30

Steps

1. Measure the resistance of your sensor under two extremes
2. Add the values and divide by two – this is your second resistor
3. To find the voltages that will result:
   Ratio = Resistor value / (Sensor resistance + resistor value)
   Resulting voltage = input voltage * ratio

Try measuring light and dark resistance of your LDR!

Find second resistor:

Light = 1 kOhm

Dark = 10 kOhm

2nd resistor = (1k + 10k) / 2 = 5.5 kOhm

Find voltages that will result:

Ratio = Resistor value / (Sensor resistance + resistor value)

Light ratio = 5.6 / (1+5.6) = 0.15

Dark ratio = 5.6/(10+5.6) = 0.67

Light voltage = 5V from Arduino * 0.15 = 0.76VDC

Dark voltage = 5V from Arduino * 0.67 = 3.21VDC