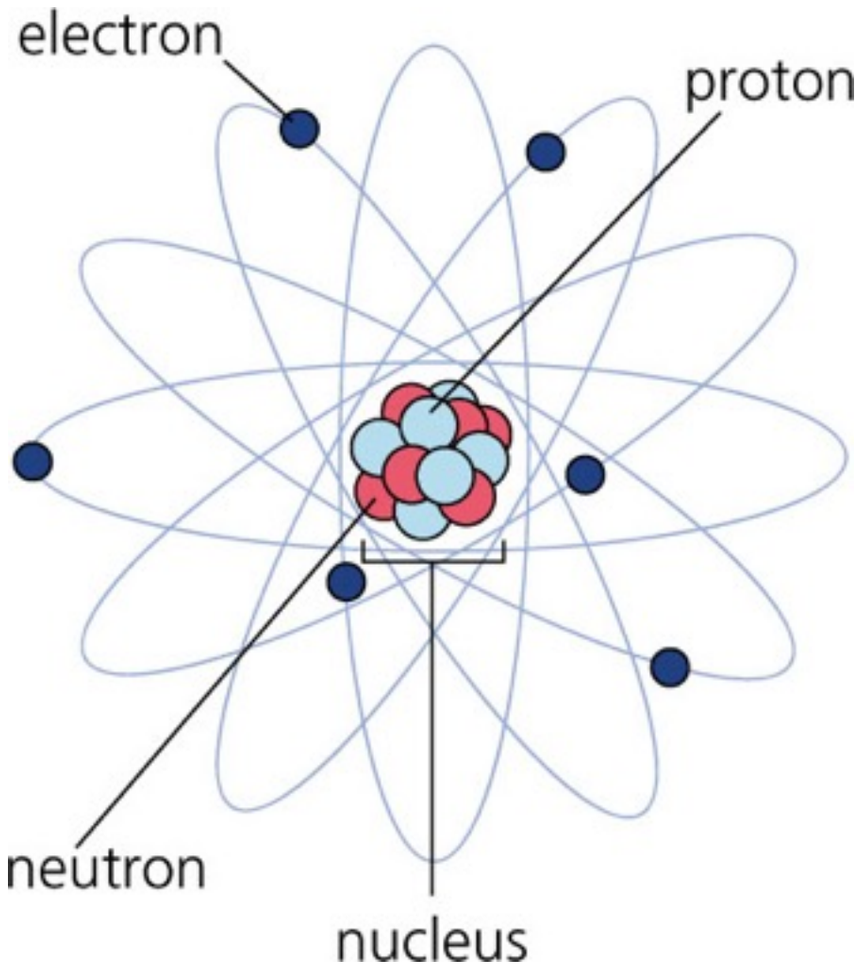
WELCOME TO

THE DUCK TAPE FILES

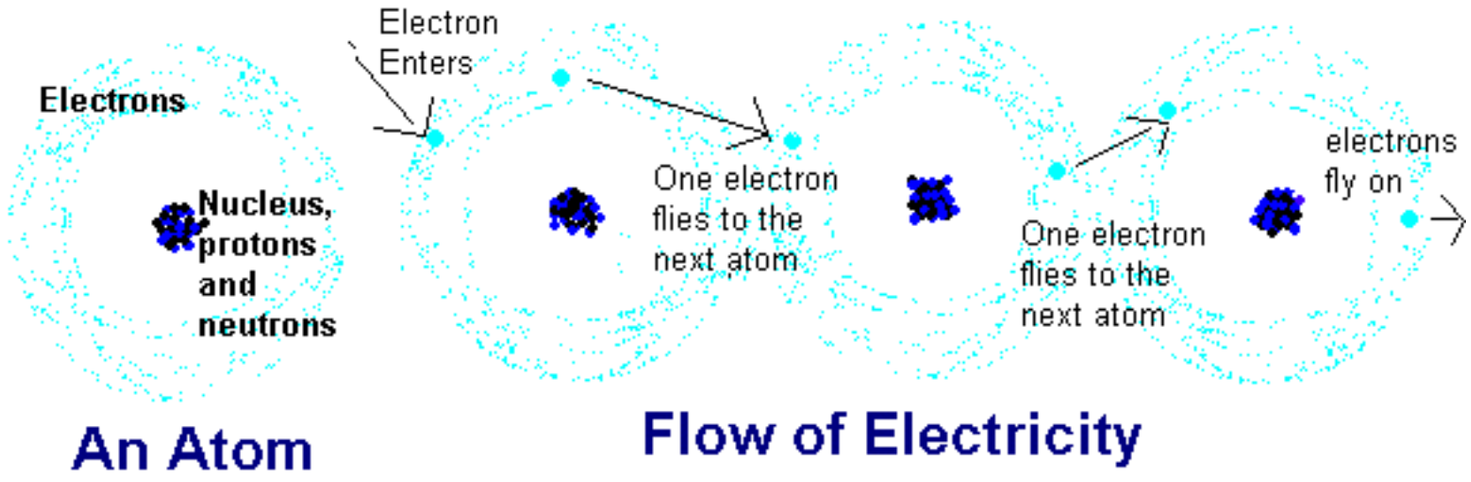
FAILURE IS **LEARNING**

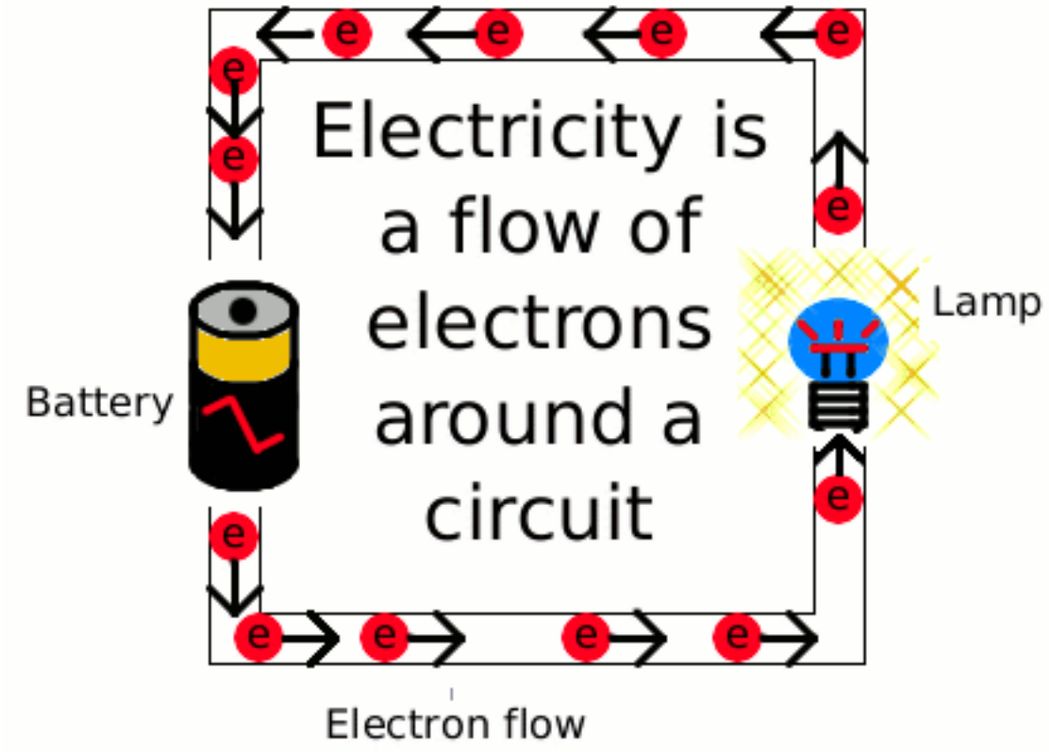
It’s all about balancing the **electrons….**

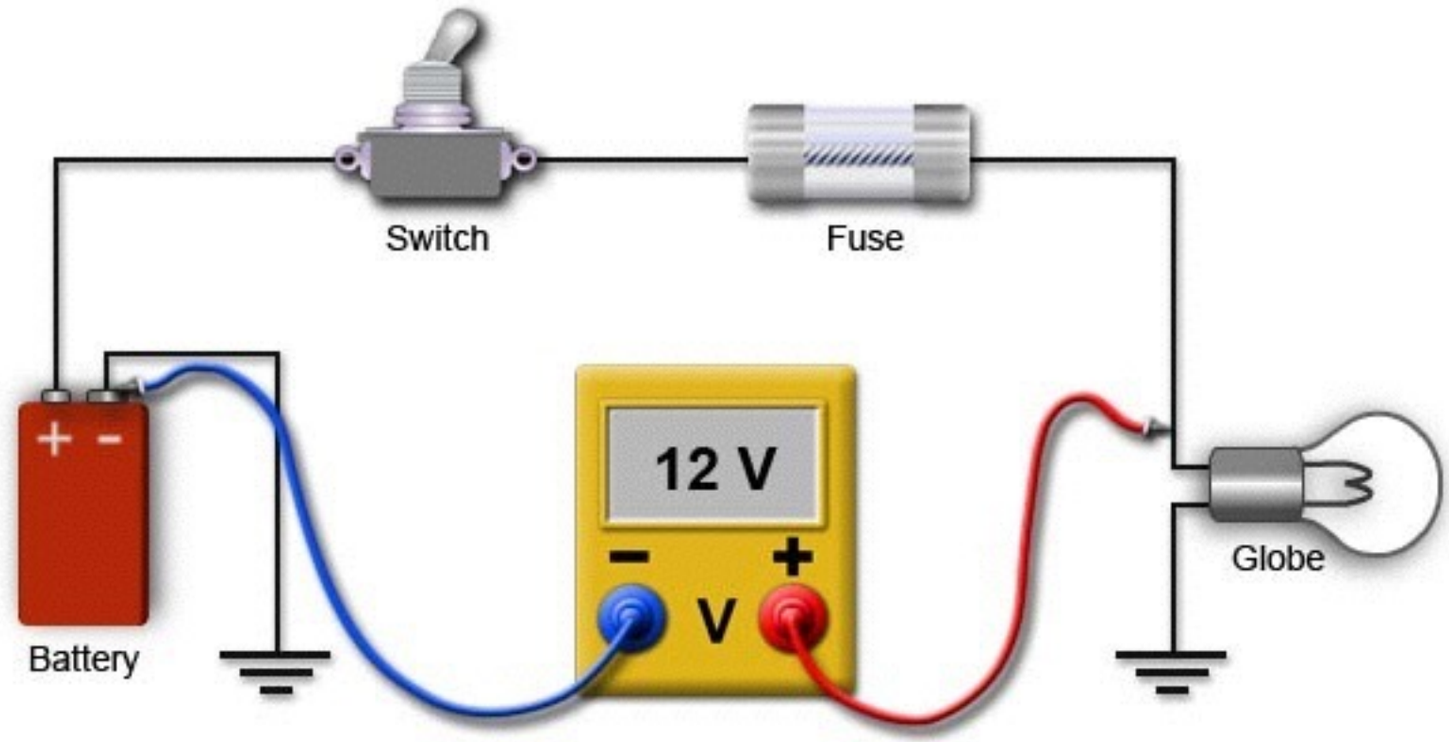


Nature likes

balance


Electrons
Nucleus, protons and neutrons
Electron Enters
One electron flies to the next atom
One electron flies to the next atom
electrons fly on
An Atom
Flow of Electricity

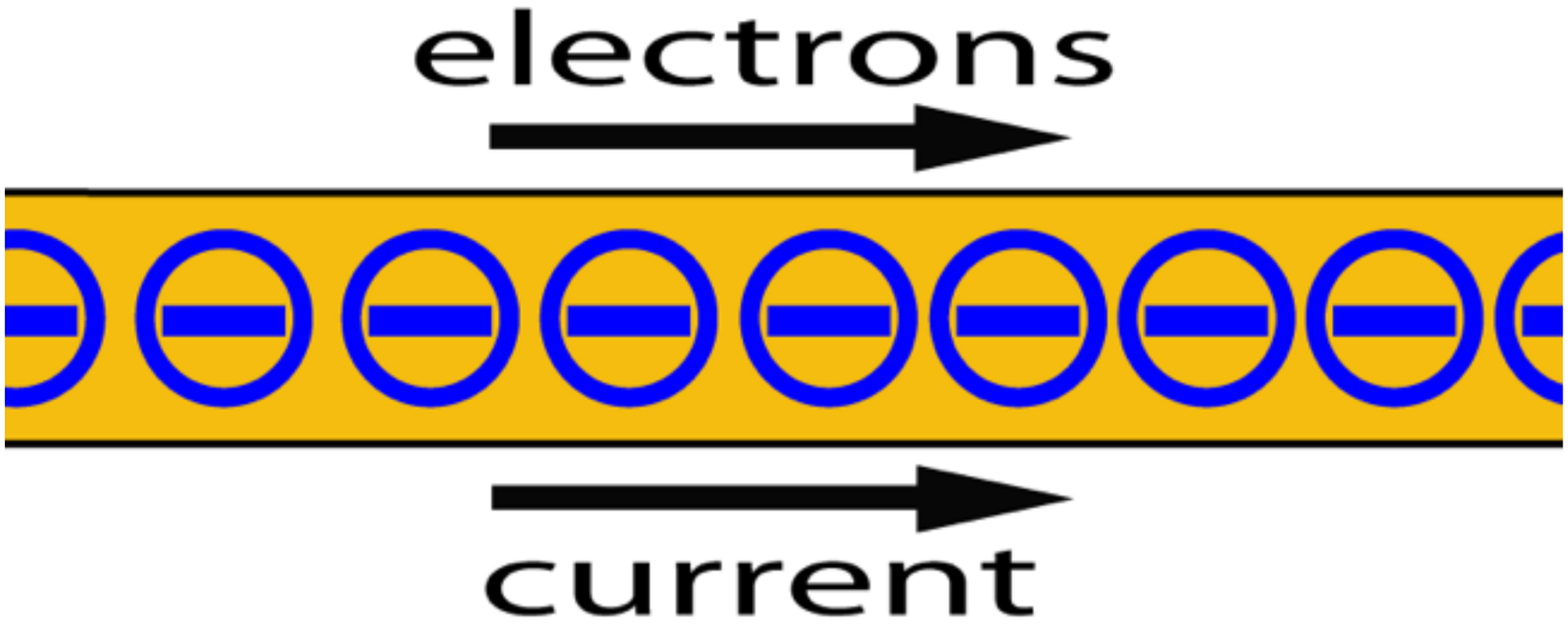

Electricity is a flow of electrons around a circuit
Battery
Lamp
Electron flow



Voltage (V)

also a volt or an EMF or as potential difference . It gets used up as it goes around the circuit. Think of it like your energy if you’re running a race.

1. What’s an electron?
2. What’s Arduino?
3. What’s electricity?

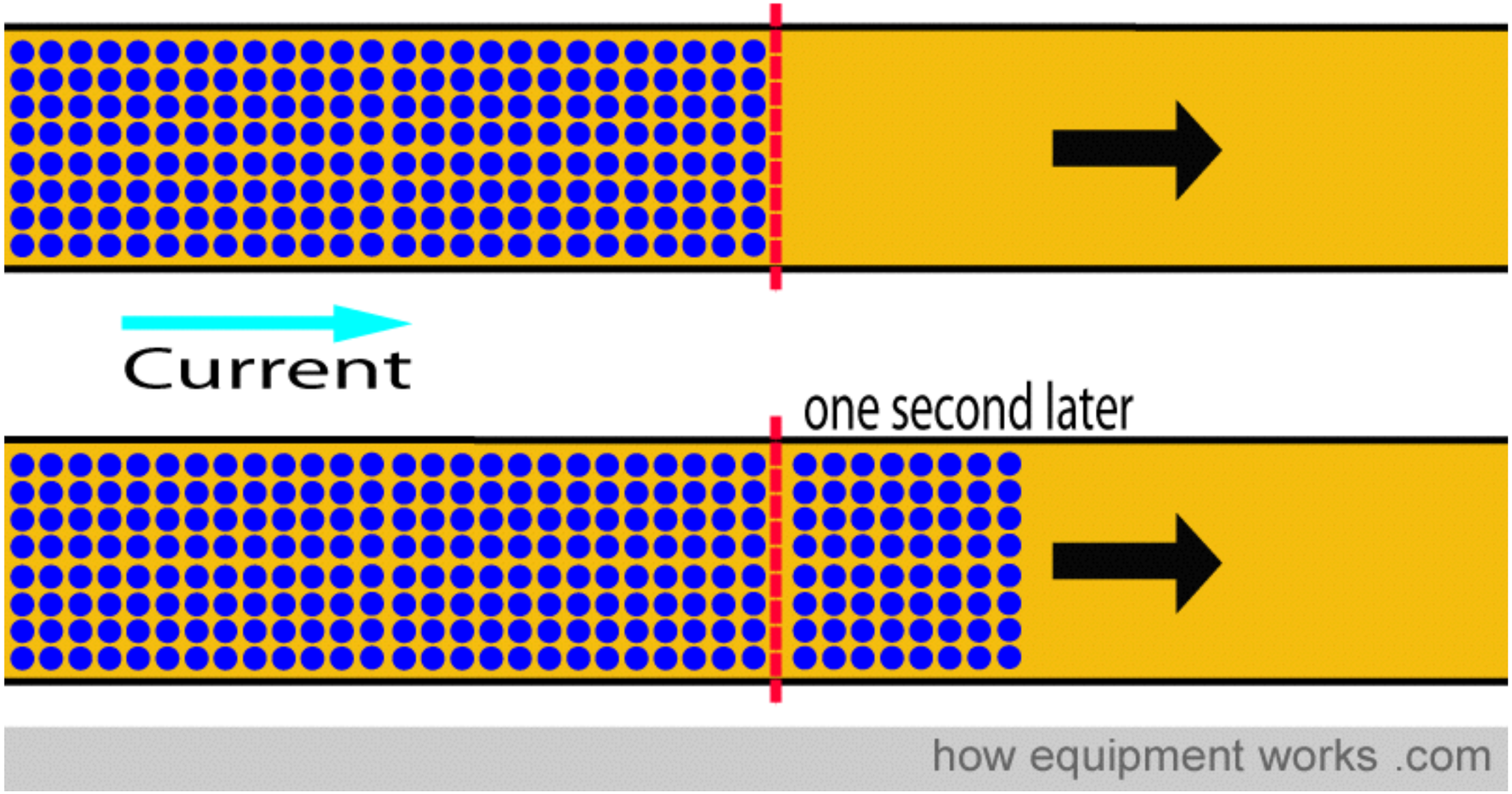


Current (I)

Electrons can be thought of as negatively charged “particles”. The movement of these electrons is called current.

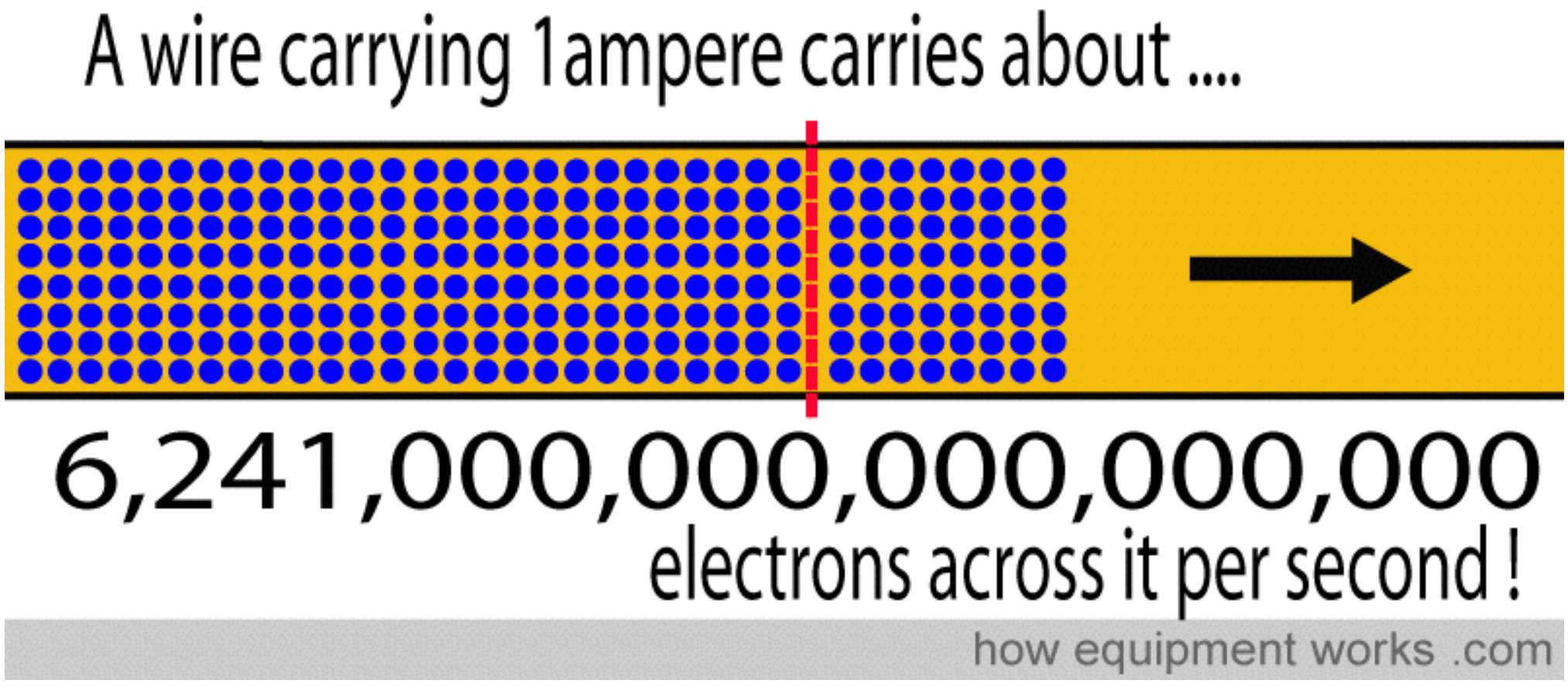
Amperes (Amps)

Current is measured in units called ‘amperes’. The number of amperes in a wire relates to how many electrons pass a cross section of the wire per second.



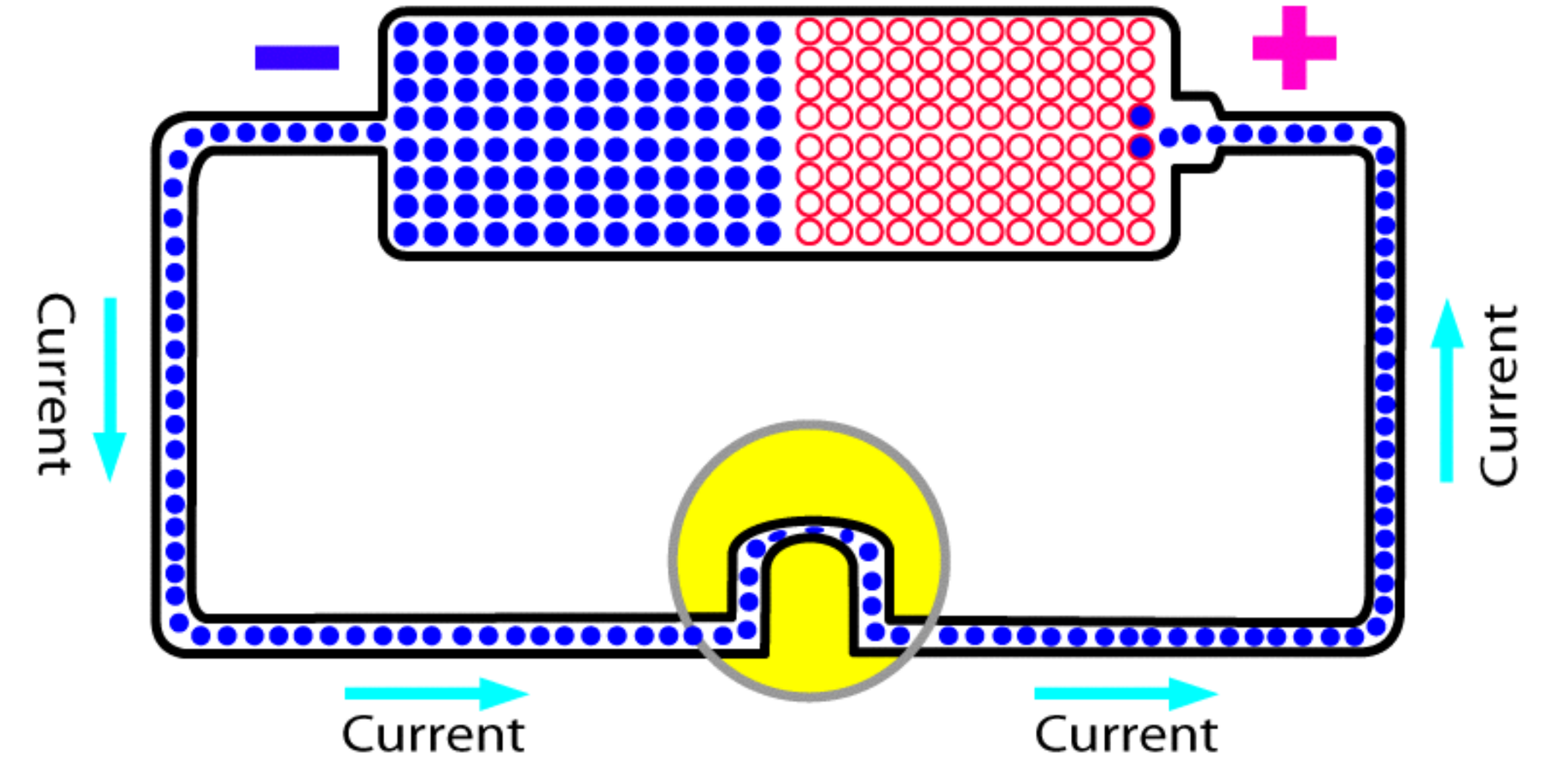
Prefix	Symbol	1000^m	10^n	Decimal	Short scale	Long scale	Since[n 1]
yotta	Y	1000^{8}	10^{24}	1 000 000 000 000 000 000 000 000	Septillion	Quadrillion	1991
zetta	Z	1000^{7}	10^{21}	1 000 000 000 000 000 000 000	Sextillion	Trilliard	1991
exa	E	1000^{6}	10^{18}	1 000 000 000 000 000 000	Quintillion	Trillion	1975
peta	P	1000^{5}	10^{15}	1 000 000 000 000 000	Quadrillion	Billiard	1975
tera	T	1000^{4}	10^{12}	1 000 000 000 000	Trillion	Billion	1960
giga	G	1000^{3}	10^{9}	1 000 000 000	Billion	Milliard	1960
mega	M	1000^{2}	10^{6}	1 000 000	Million		1960
kilo	k	1000^{1}	10^{3}	1 000	Thousand		1795
hecto	h	$1000^{2/3}$	10^{2}	100	Hundred		1795
deca	da	$1000^{1/3}$	10^{1}	10	Ten		1795
		1000^{0}	10^{0}	1	One		–
deci	d	$1000^{-1/3}$	10^{-1}	0.1	Tenth		1795
centi	c	$1000^{-2/3}$	10^{-2}	0.01	Hundredth		1795
milli	m	1000^{-1}	10^{-3}	0.001	Thousandth		1795
micro	μ	1000^{-2}	10^{-6}	0.000 001	Millionth		1960
nano	n	1000^{-3}	10^{-9}	0.000 000 001	Billionth	Milliardth	1960
pico	p	1000^{-4}	10^{-12}	0.000 000 000 001	Trillionth	Billionth	1960
femto	f	1000^{-5}	10^{-15}	0.000 000 000 000 001	Quadrillionth	Billiardth	1964
atto	a	1000^{-6}	10^{-18}	0.000 000 000 000 000 001	Quintillionth	Trillionth	1964
zepto	z	1000^{-7}	10^{-21}	0.000 000 000 000 000 000 001	Sextillionth	Trilliardth	1991
yocto	y	1000^{-8}	10^{-24}	0.000 000 000 000 000 000 000 001	Septillionth	Quadrillionth	1991

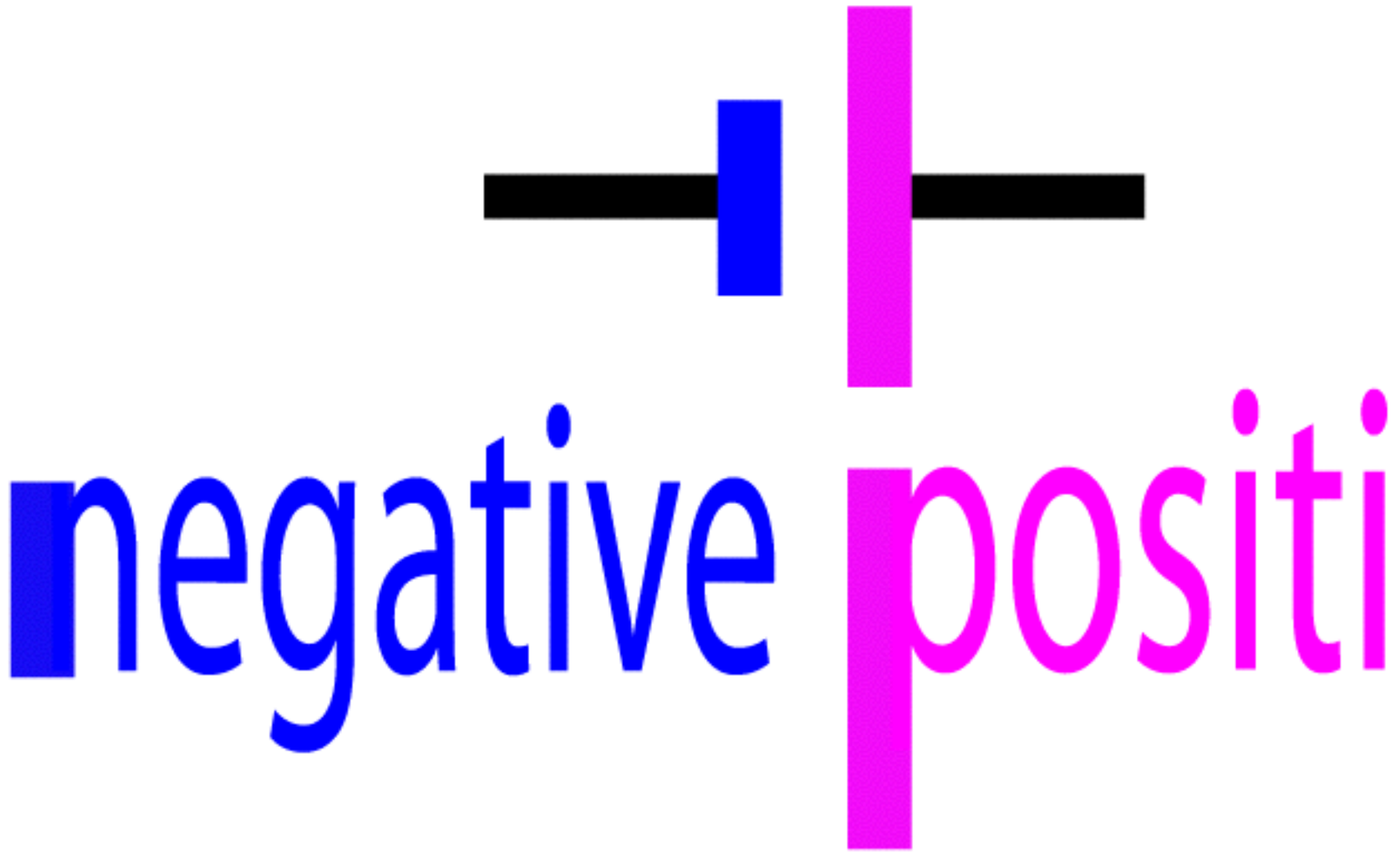
A current of one ampere relates to a certain number of electrons passing a cross section of the wire in one second. This number is absolutely huge, and please don't bother to remember it. The wire below is carrying one ampere of current.

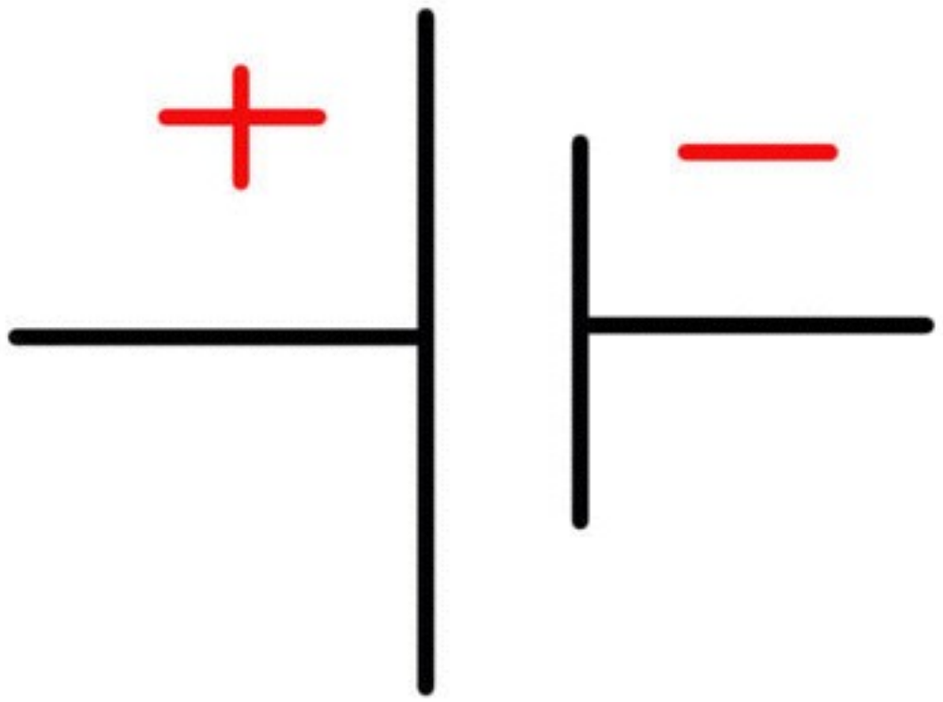


1. What's V?
2. What's I?
3. What's an R?

What’s a circuit?



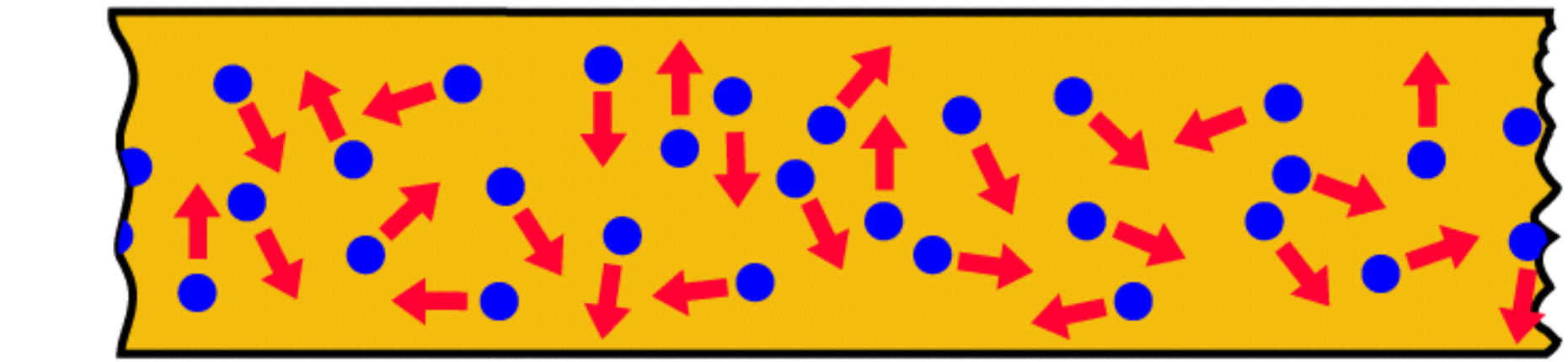


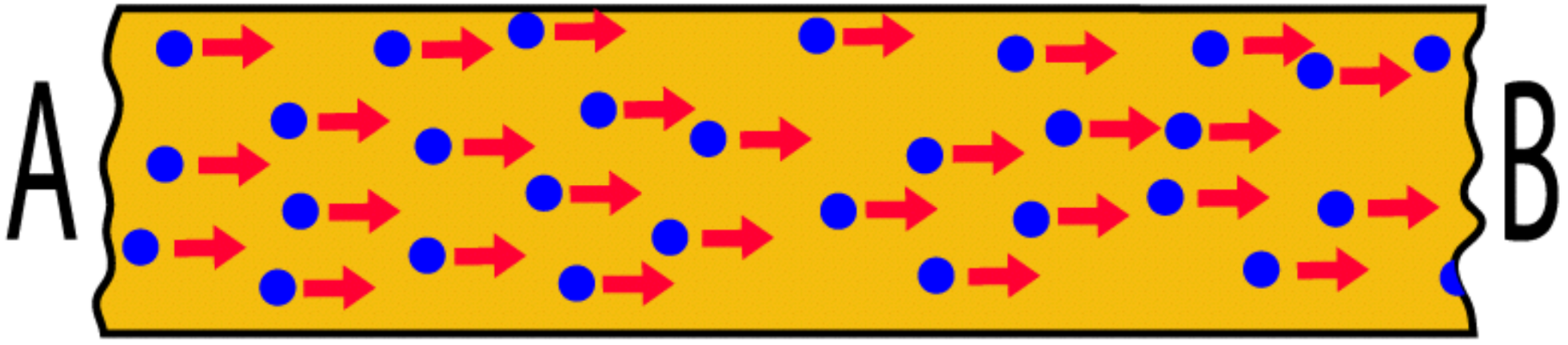


BATTERY

longer lead is postive.

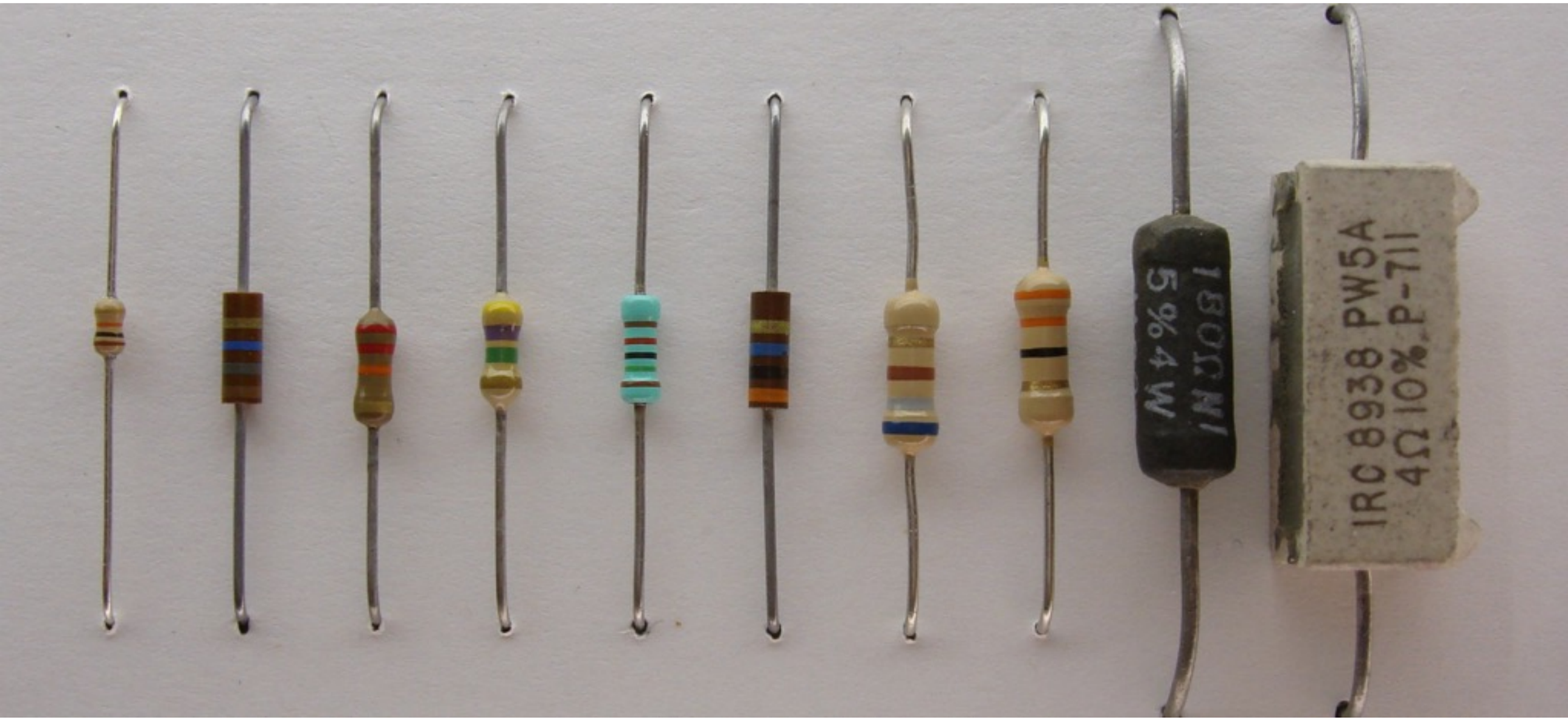
http://www.instructables.com/id/HOW-TO-READ-CIRCUIT-DIAGRAMS/



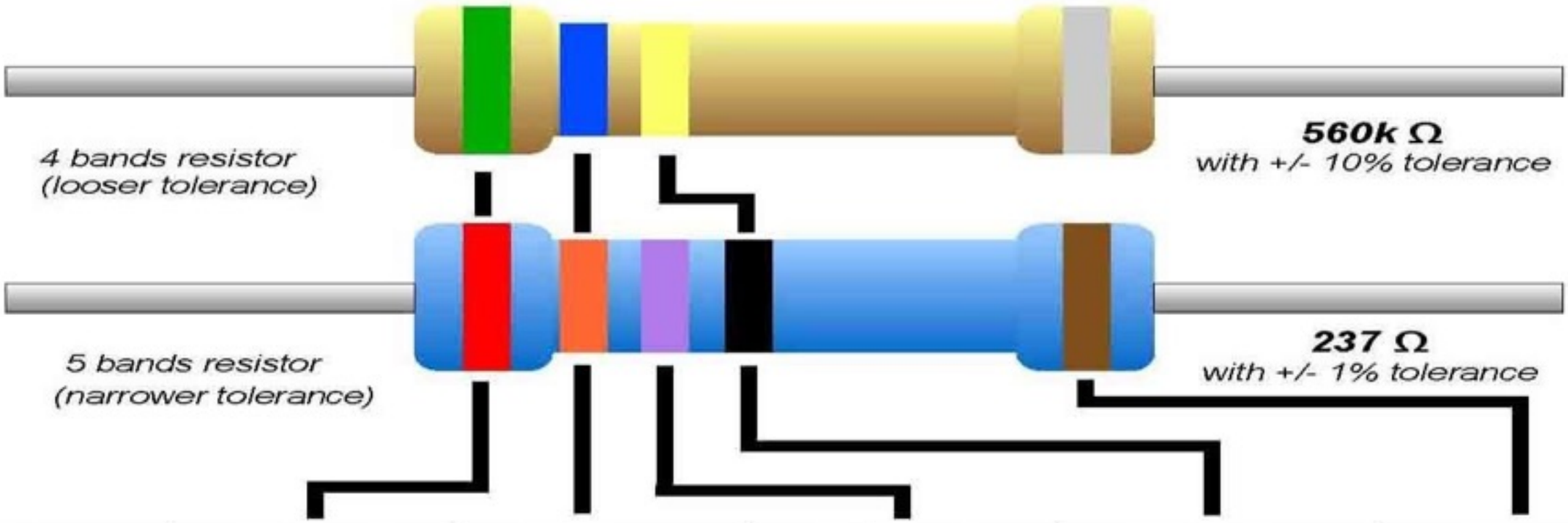


Resistance (R)

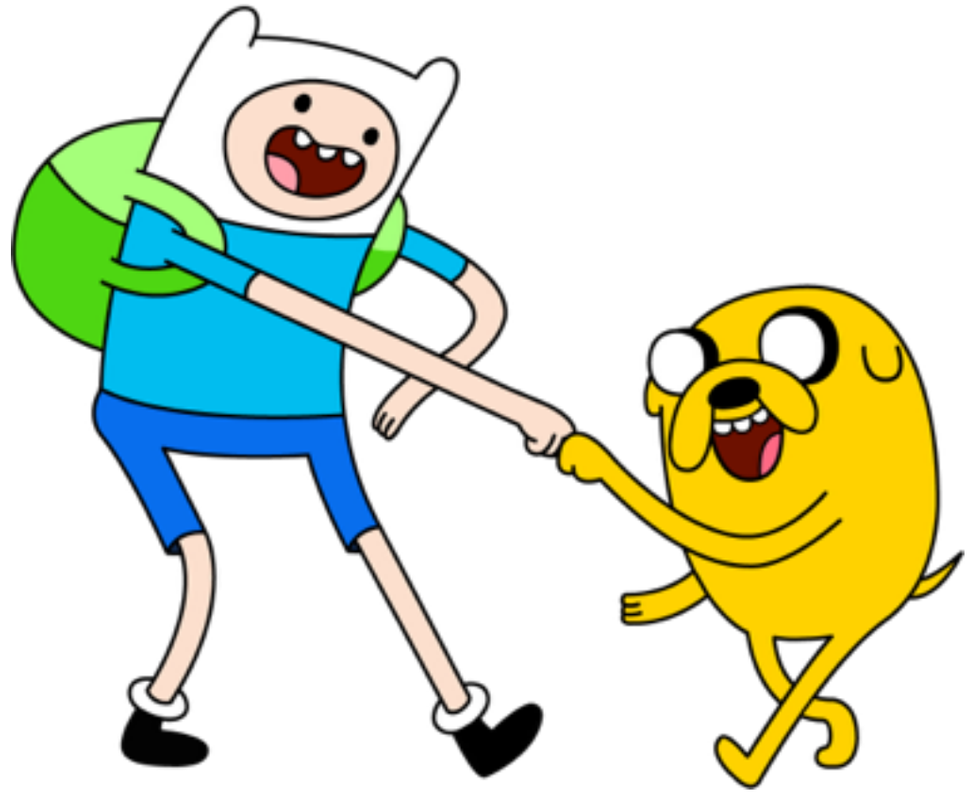
How easily can the current flow?


IRC 893
4Ω 10
P-711

Resistor Color Code



Color	1st Band	2nd Band	3rd Band	Multiplier	Tolerance
Black	0	0	0	x 1 Ω	
Brown	1	1	1	x 10 Ω	+/- 1%
Red	2	2	2	x 100 Ω	+/- 2%
Orange	3	3	3	x 1K Ω	
Yellow	4	4	4	x 10K Ω	
Green	5	5	5	x 100K Ω	+/- .5%
Blue	6	6	6	x 1M Ω	+/- .25%
Violet	7	7	7	x 10M Ω	+/- .1%
Grey	8	8	8		+/- .05%
White	9	9	9		
Gold				x .1 Ω	+/- 5%
Silver				x .01 Ω	+/- 10%



1. What’s a circuit?
2. Which foot of the LED is positive
3. What’s a resistor?

Ohm's law

- Ohm's law says *that the tension is equal to the product of the intensity and the resistance*

$$V = R \cdot I$$

- *This is equivalent to:*

$$I=V/R \leftrightarrow R=V/I$$

How much power is spent?

P = VI

power is referred to as watts W

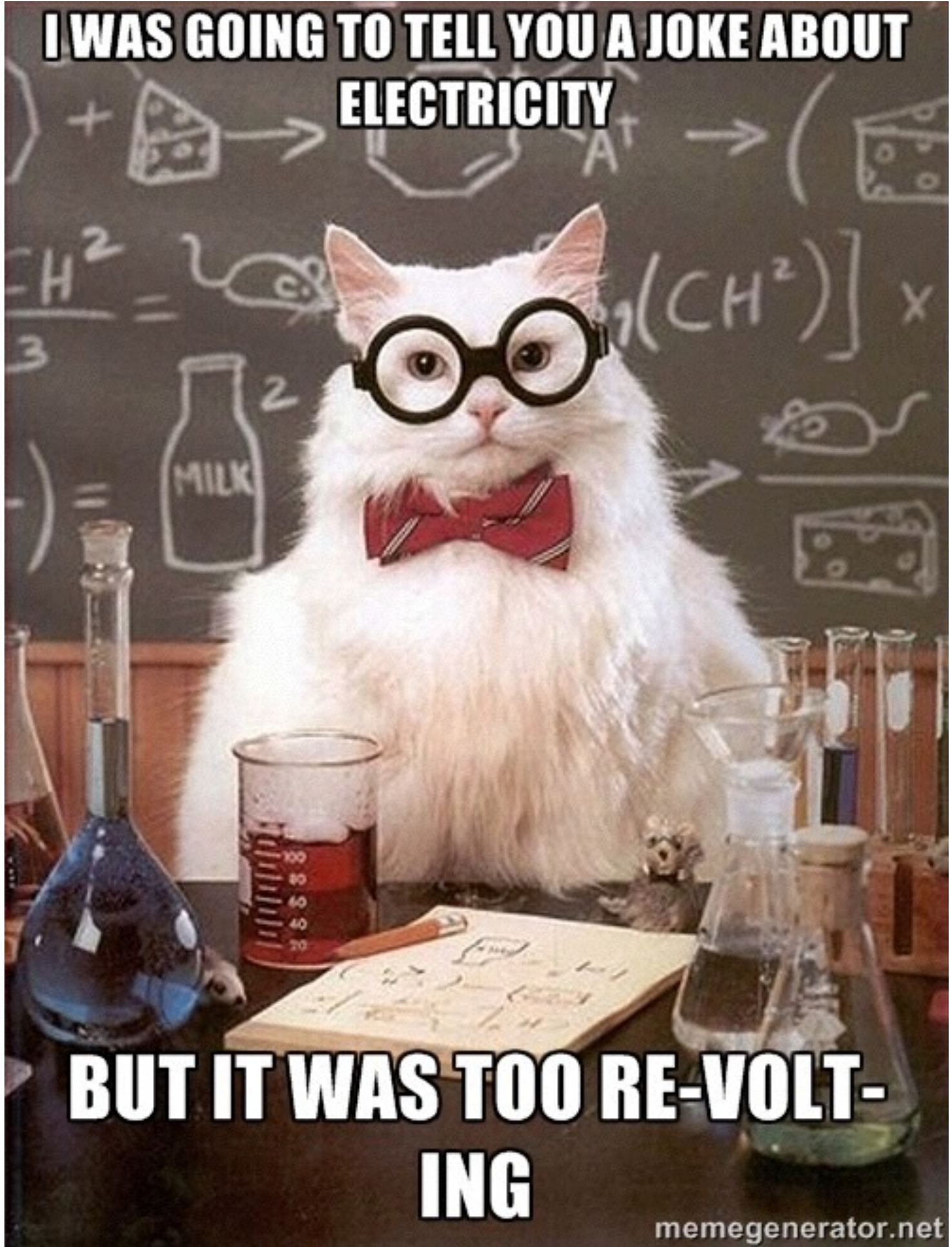
The power goes into heat usually or sometimes mechanical work (like a robot motor)

this is why your laptop can get hot

mechanical work = **motor**

radiated energy = **lamps, transmitters**

stored energy = **battery, capacitors, inductors**


I WAS GOING TO TELL YOU A JOKE ABOUT ELECTRICITY
MILK
BUT IT WAS TOO RE-VOLT-ING
memegenerator.net

And now on to the

microcontroller

Usually you'll be prototyping on a **breadboard**

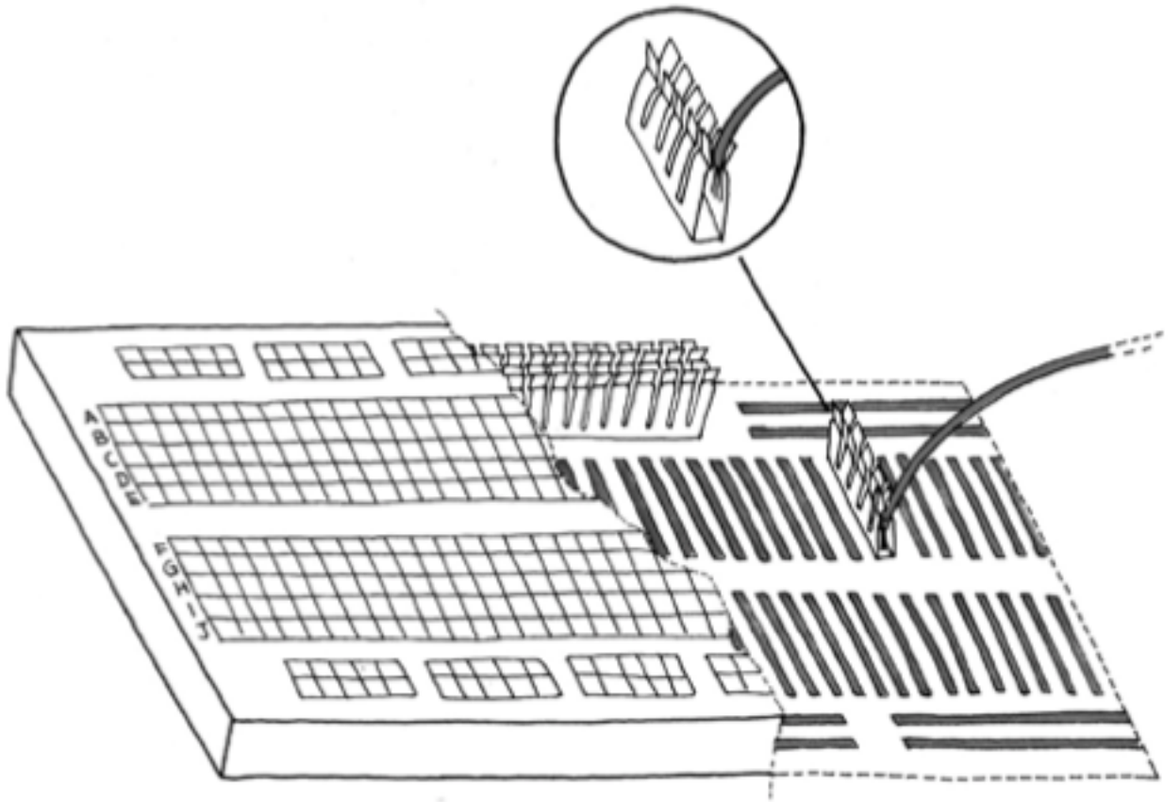
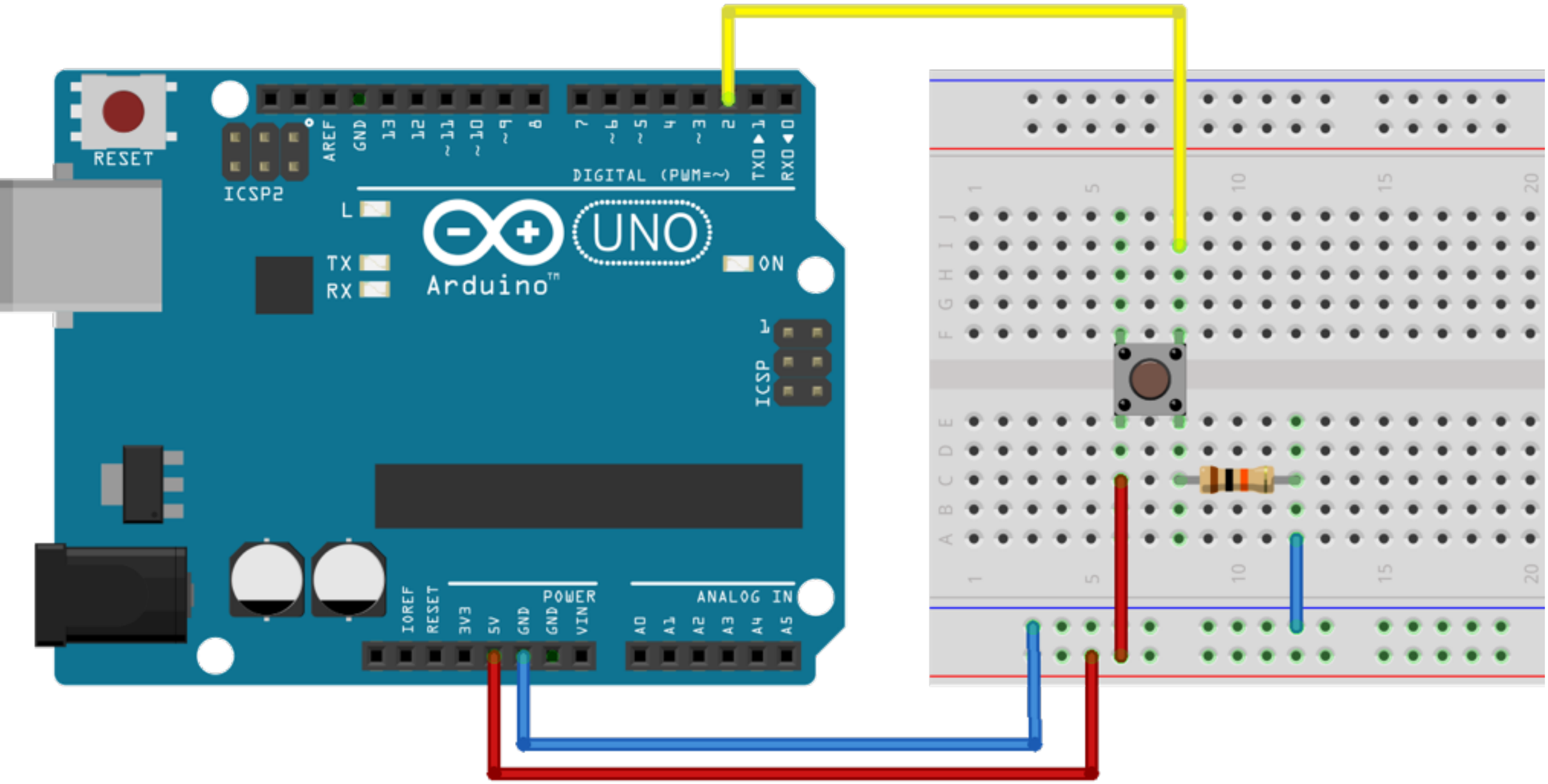


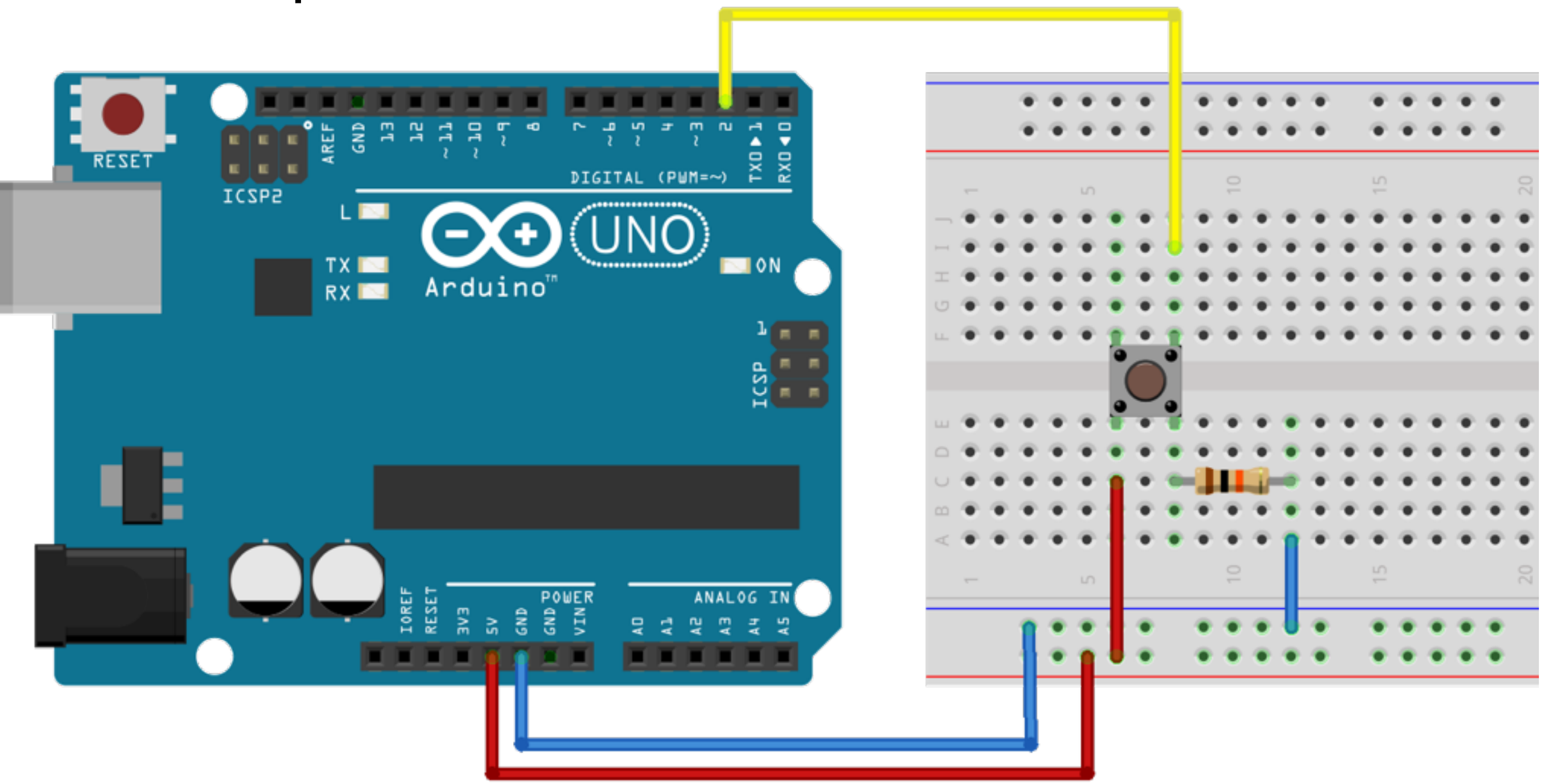
Figure A-1.
The solderless breadboard

You will be looking to connect your hardware to the **arduino pins**



If set to output, they send out **five volts**

and up to **40 mA of current**



THE TWO MOST COMMON USE OF PINS

Digital & Analog* (PWM)

Get the data in

Send the data out

DIGITAL

ON/OFF

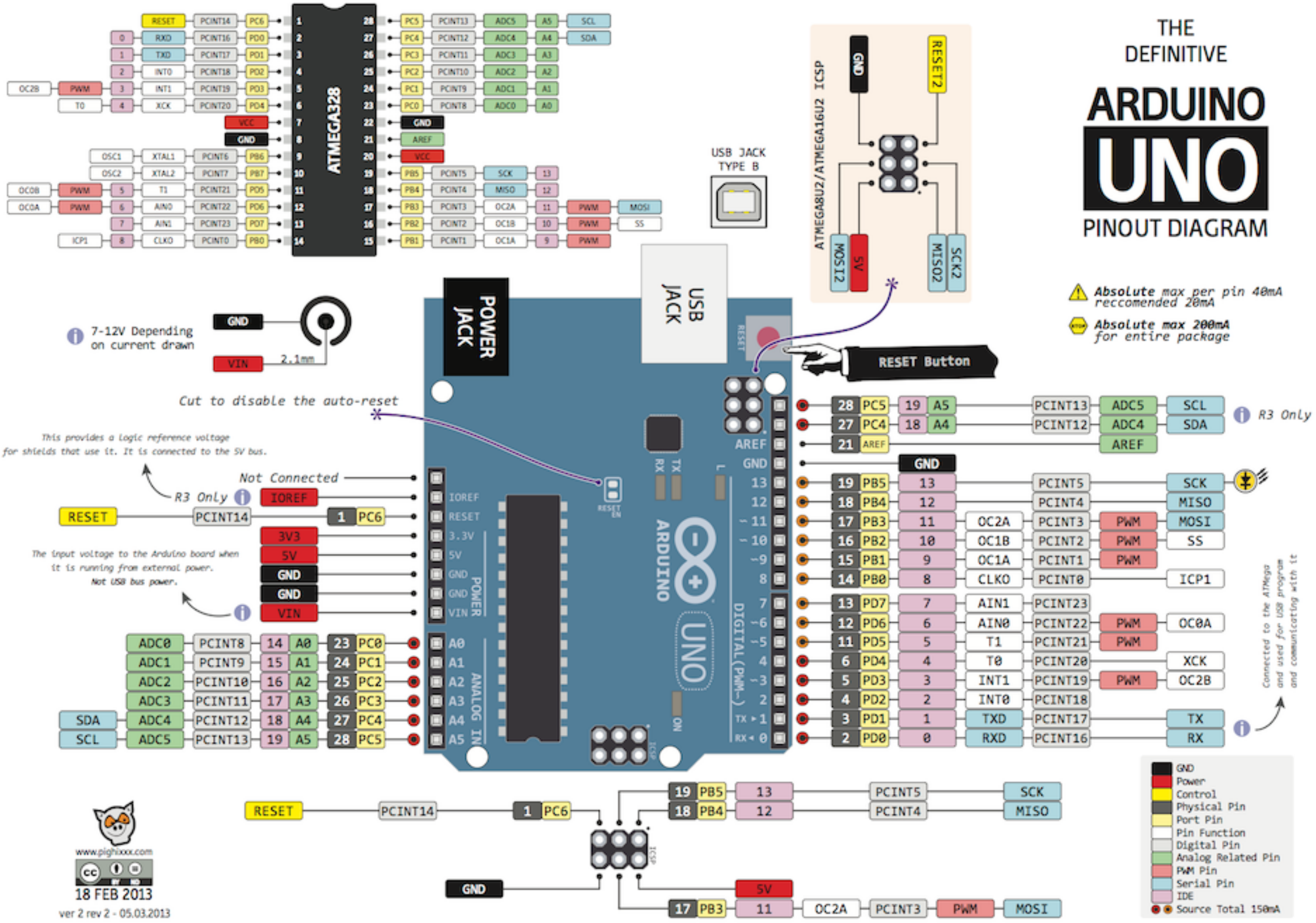
0V or 5V

PWM / ANALOG

0-255 / 0-1024

Voltage varies between 0 and 5V.
Same with current.

THE DEFINITIVE ARDUINO UNO PINOUT DIAGRAM



www.pighixxx.com

18 FEB 2013

ver 2 rev 2 - 05.03.2013

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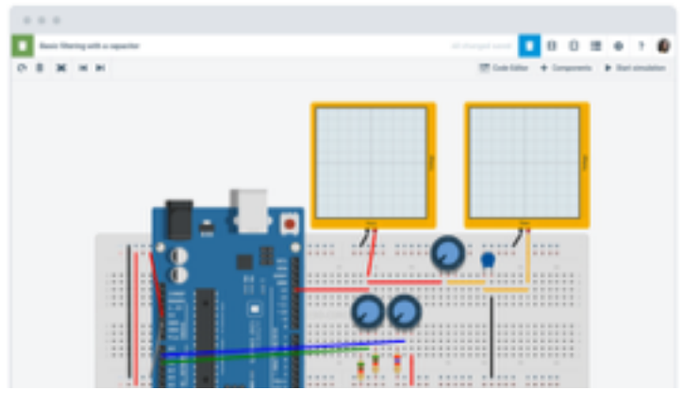
Test your Arduino code in our real-time simulation environment and see your designs come to life in the browser.



https://circuits.io/

Blink | Arduino 1.7.7

Blink

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

 Most Arduinos have an on-board LED you can control. On the Uno and
 Leonardo, it is attached to digital pin 13. If you're unsure what
 pin the on-board LED is connected to on your Arduino model, check
 the documentation at http://arduino.cc

 This example code is in the public domain.

 modified 8 May 2014
 by Scott Fitzgerald
*/


// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin 13 as an output.
  pinMode(13, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  digitalWrite(13, HIGH);   // turn the LED on (HIGH is the voltage level)
  delay(1000);              // wait for a second
  digitalWrite(13, LOW);    // turn the LED off by making the voltage LOW
  delay(1000);              // wait for a second
}
```

Arduino has two main loops just like processing.

1. setup(){}

Set your pins up here as input or output using the pinMode function.

signature: **`pinMode(pinNumber, MODE)`**

Mode is either **`INPUT`** or **`OUTPUT`** mainly…

2. loop(){}

Write or read to your pins and do any timing or computation.

Steps to get / send data for each pin

1. Create an int for the pin number outside the scope of your functions
2. Set the pinMode as input or output in setup()
3. Write to the pin or read from pin in loop()
4. If you read, you'll want to save that data to another variable in loop()

Join a

HACKER SPACE

https://wiki.hackerspaces.org/Hackerspaces

RESOURCES

http://www.allaboutcircuits.com/

MAKE MAGAZINE

INSTRUCTABLES

ADAFRUIT TUTORIALS

DESIGN

VISIBILITY -

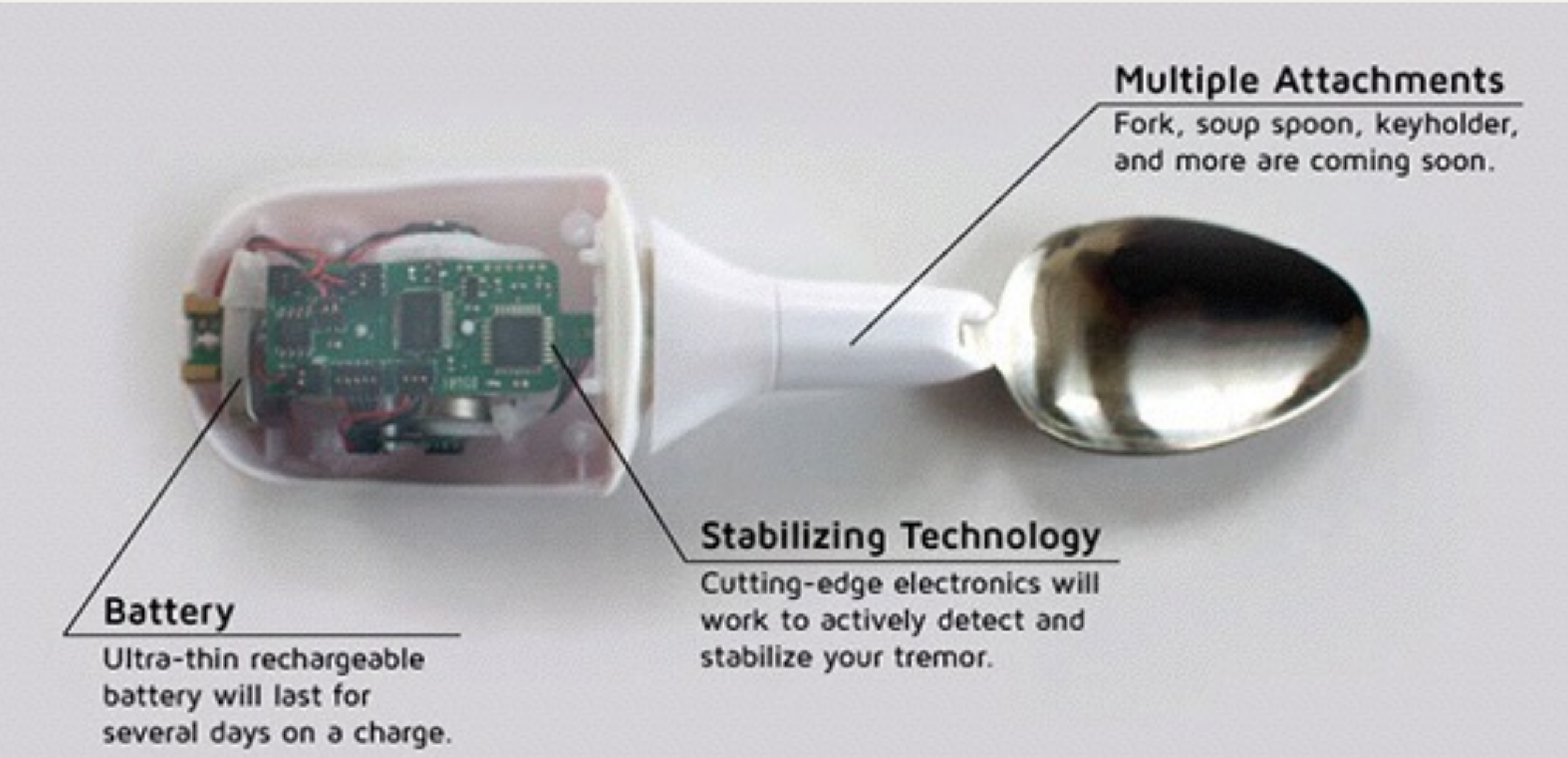
The interface must have visible features, inferring the right messages to us

NATURAL SIGNALS

The natural or common understanding of objects and their perceived use

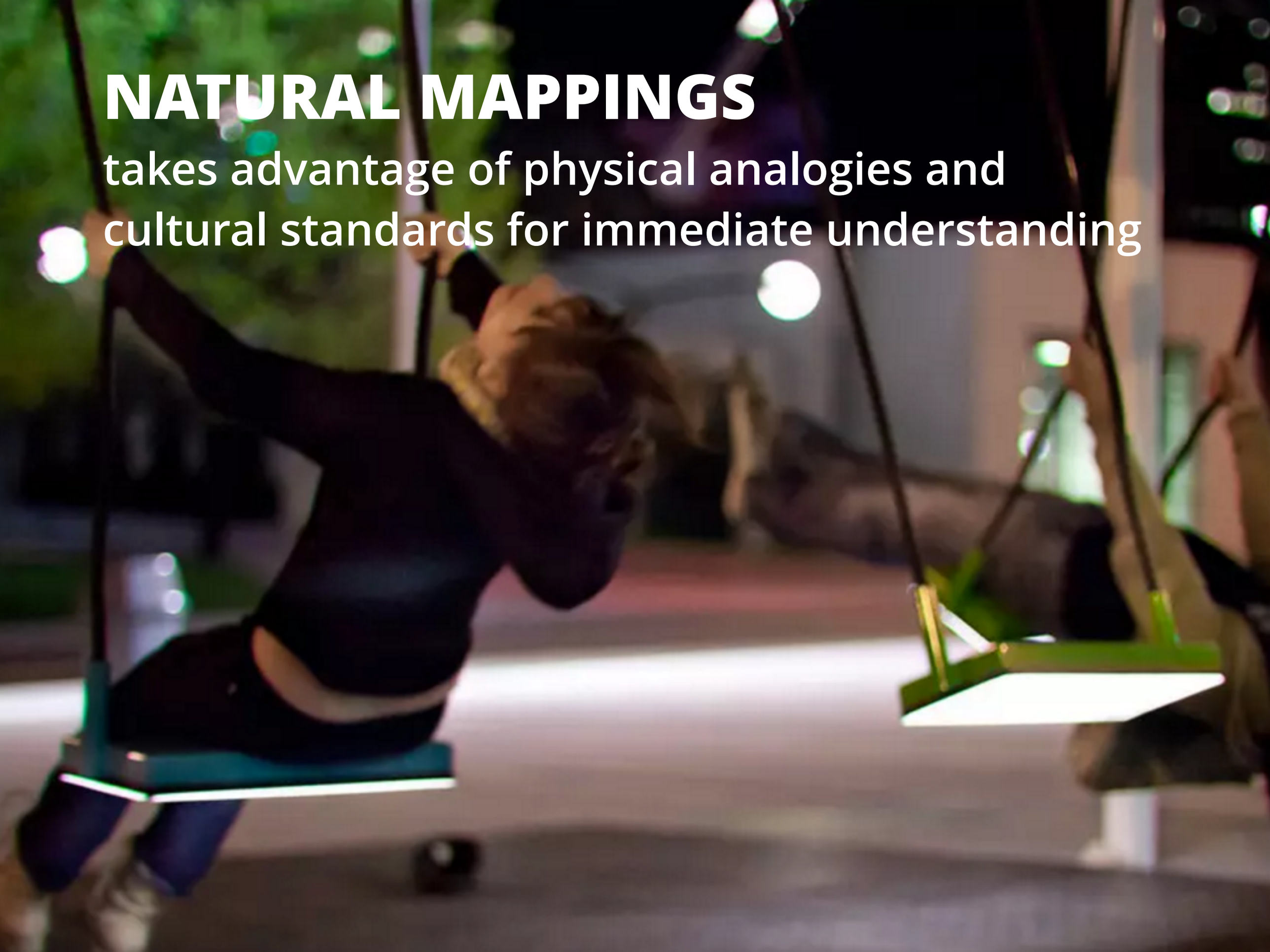
NATURAL DESIGN

Design that leverages our understanding of the natural world



DESIGN MAPPINGS

Our link between what you want to do and what is perceived possible



NATURAL MAPPINGS

takes advantage of physical analogies and cultural standards for immediate understanding

AFFORDANCE

the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used
(e.g. a chair affords sitting; glass affords seeing through, breaking; wood affords solidity, opacity, support, carving)

AFFORDANCE

The clue provider



Constraints

limits to the perceived operation of a device

“Design depends largely on constraints”

— Charles Eames

Design Situation → Design Opportunity ← location photographs

(+ research)

Design Brief

Design & make

(what?) + (do what?)

Design Considerations & Constraints (or limitations)

- bottle → mouth Ø size
- type → common % bottles.
- user
- context / environment
- ergonomics

Research

(1) ONE FUNCTION ... different ways to ...

Idea Generation

- sketch + annotate
- one proposal
- many views
- drawing techniques

(2) SHAPE & FORM
AESTHETICS

colors
materials
jointing

(1) Design Specifications.

- specific weight
- noc.
- dimensions
- etc.

- The product must have a Ø of > than ? mm.
- ...
- ....

mrdanielson@yahoo.com · FS

space

stress

kinematics

weight

deflection

material

force

cost

flow

geometry

In every design attempt, there will be limitations or constraints or some form of hindrance. Some projects may be constrained by physical space or budget. Some limited by the choice of materials. And most with a time constraint.

Conceptual Model

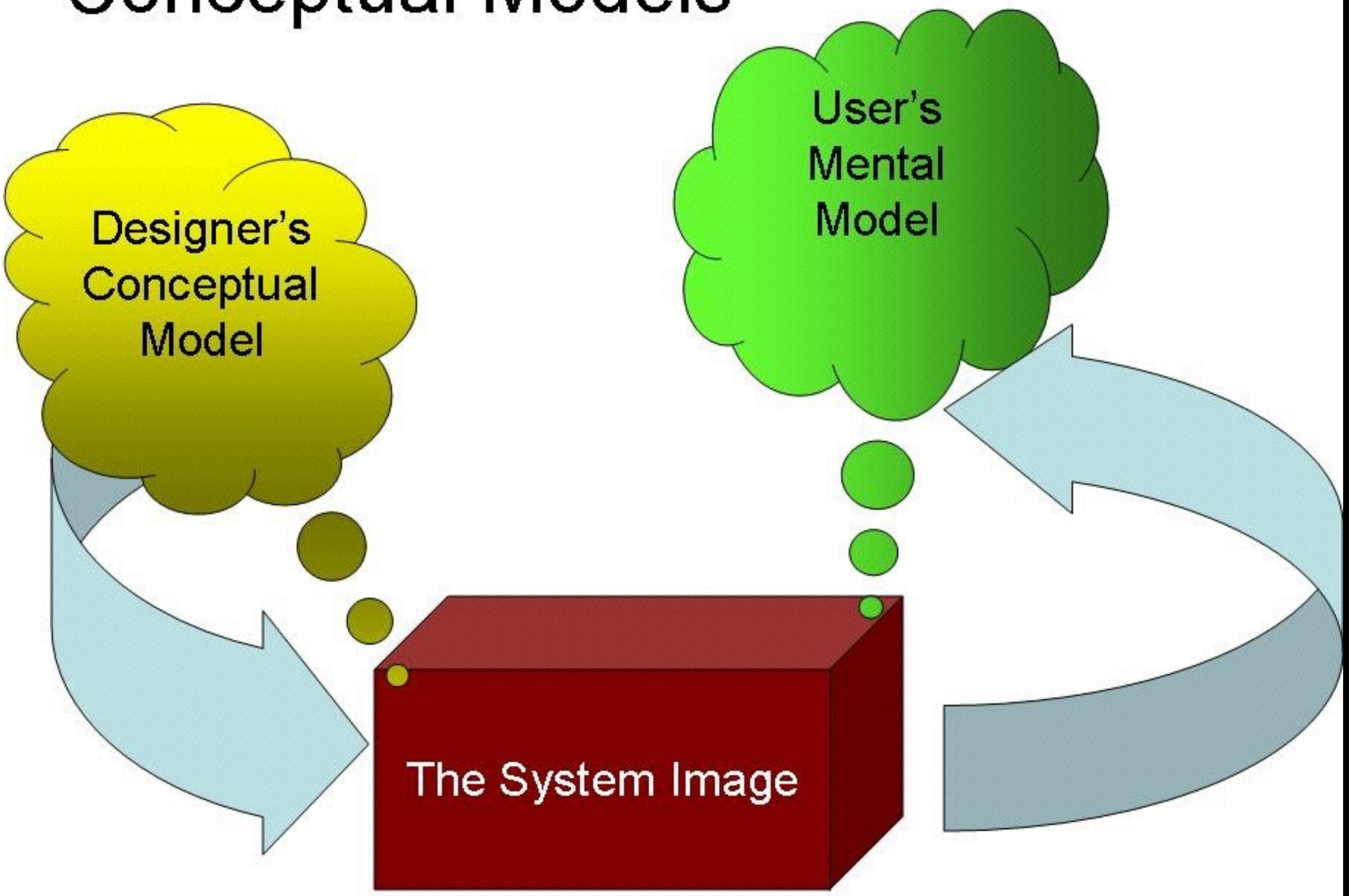
The designer's mental simulation of a device's operation.

These can be based on MAPPINGS, AFFORDANCES and CONSTRAINTS.

What are mental models?

"Models people have of themselves, others, their environment, and the things they interact with"

Conceptual Models



SYSTEM IMAGE

System Image – the visible part of the device being used. If incomplete / contradictory, the user cannot easily use the device.


VISION
Pearl

FEEDBACK

sending information back to the user about what action has actually been done and what result was accomplished