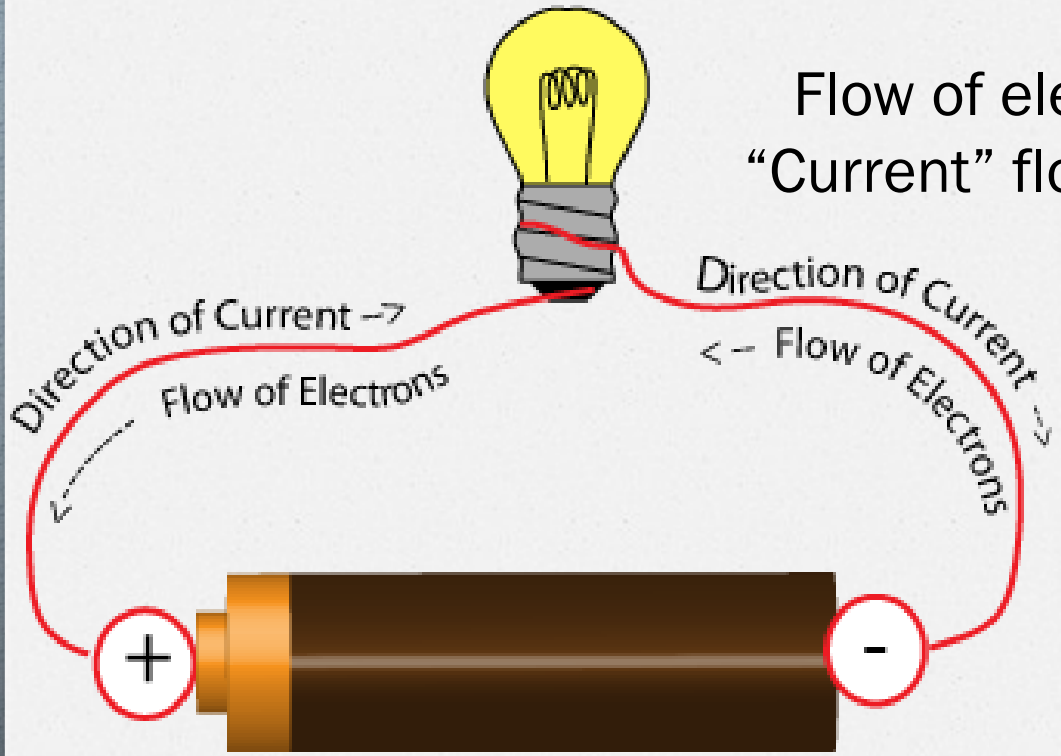
Circuit Wizardry Workshop #3

Presented by:
Optics Society at the University of Michigan

Current



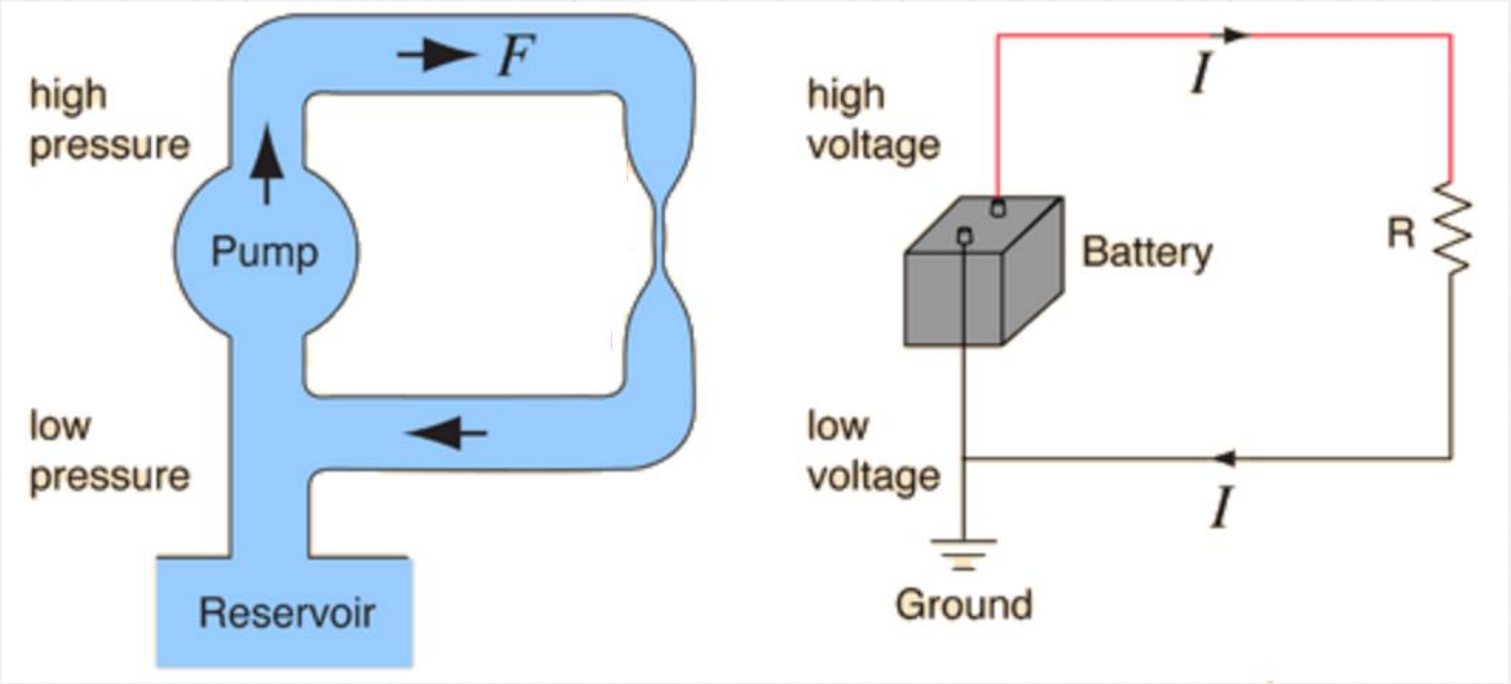
Flow of electrons (like a river)

"Current" flows from (+) side of battery to (-) side

Electrons go the other way

Voltage

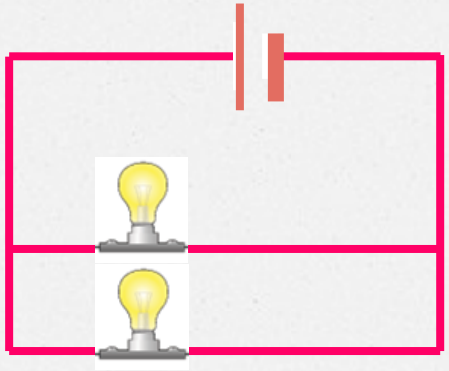
Voltage is like pressure (sort of)



How to tell parallel & series?

Two components are in **parallel** if:

Same sides of each component are both connected together with wires



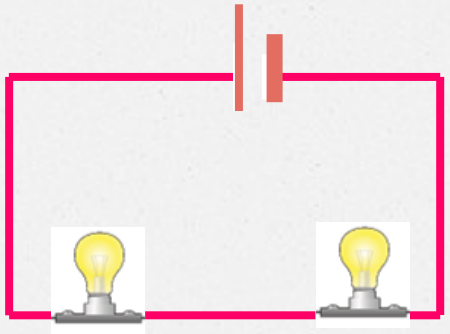
(front to front AND back to back)

How to tell parallel & series?

Two components are in **series** if:

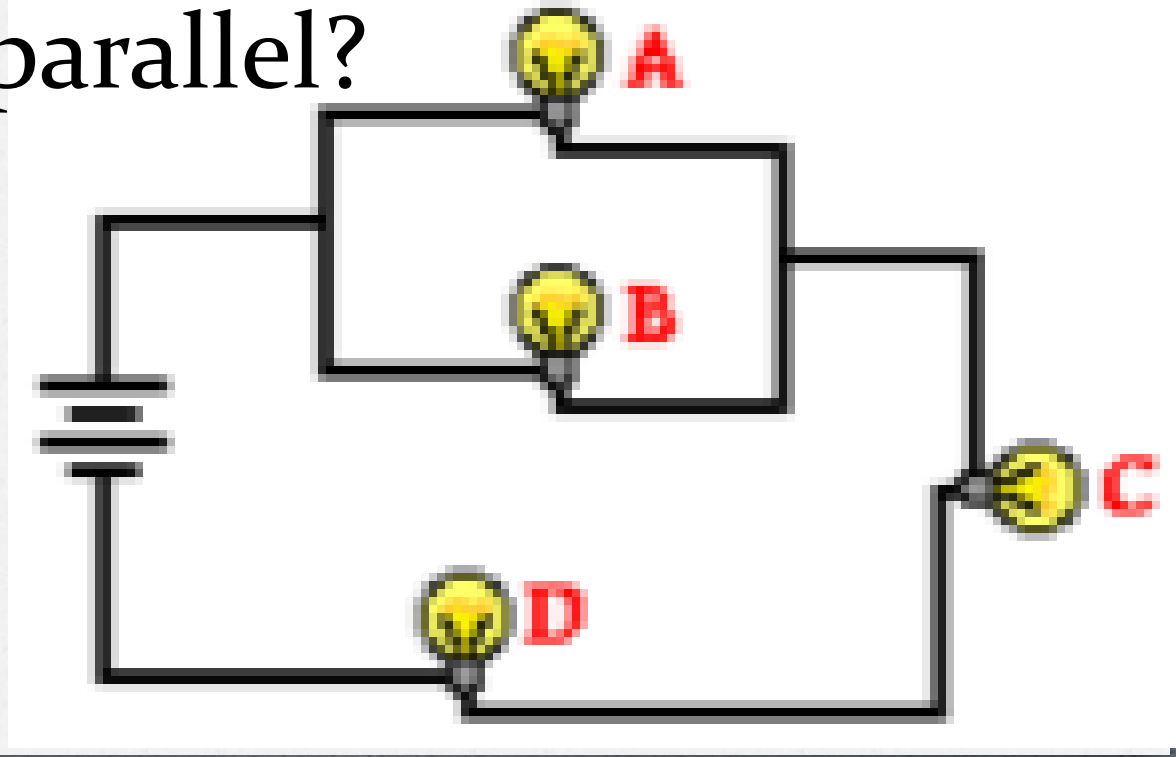
At least one set of opposite sides of each component are connected DIRECTLY together with a wire

(front to back OR back to front)



What is in series?

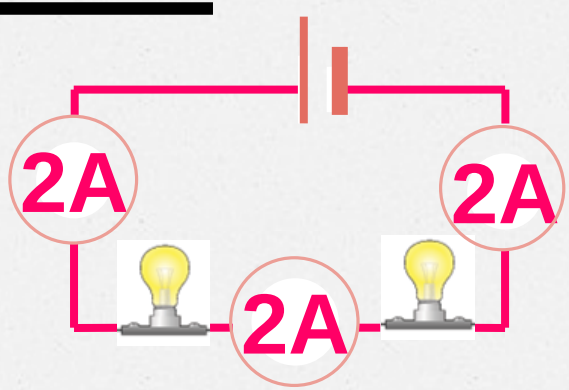
What is parallel?



Current

SERIES CIRCUIT

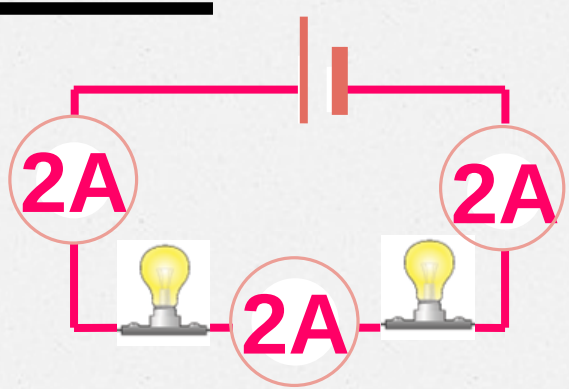
- current is the **same** at all points in the circuit.



Current

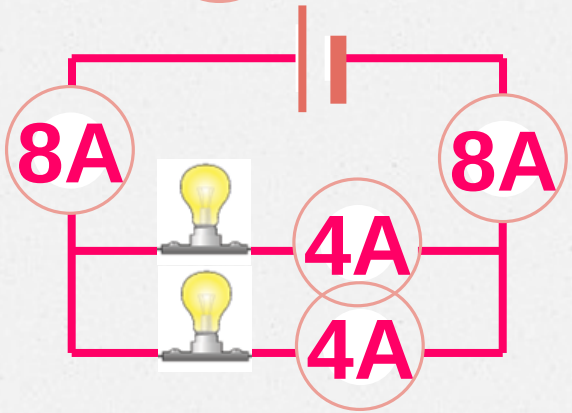
SERIES CIRCUIT

- current is the **same** at all points in the circuit.



PARALLEL CIRCUIT

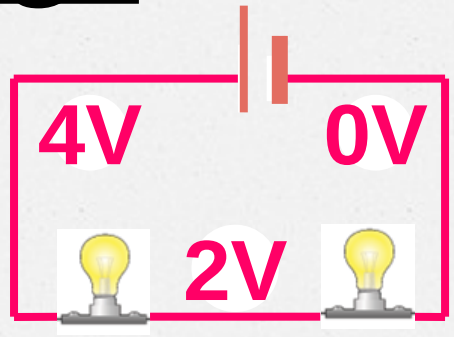
- current is **split** between each branch



Voltage

SERIES CIRCUIT

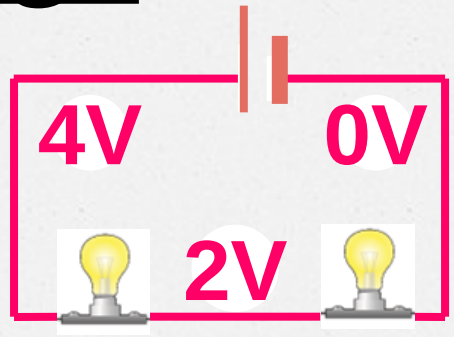
- voltage is the **split** across components



Voltage

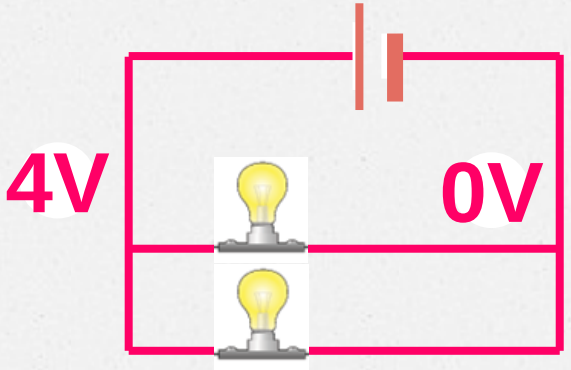
SERIES CIRCUIT

- voltage is the **split** across components

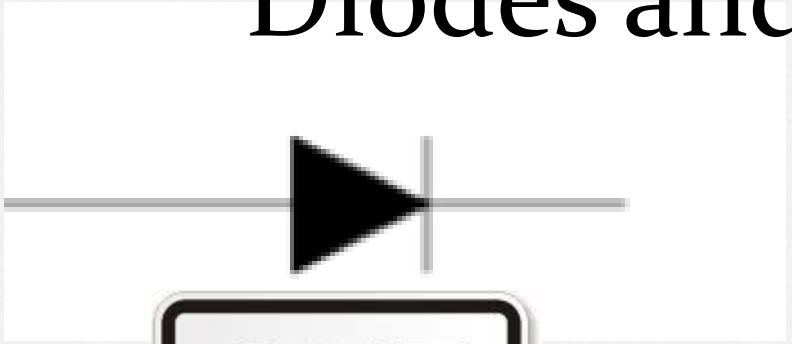


PARALLEL CIRCUIT

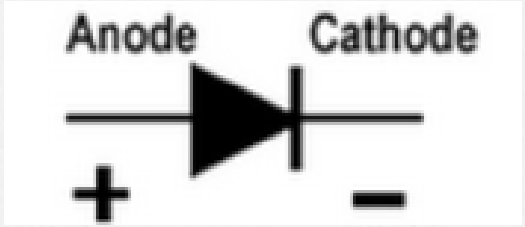
- voltage is **same** across each branch



Diodes and LEDs



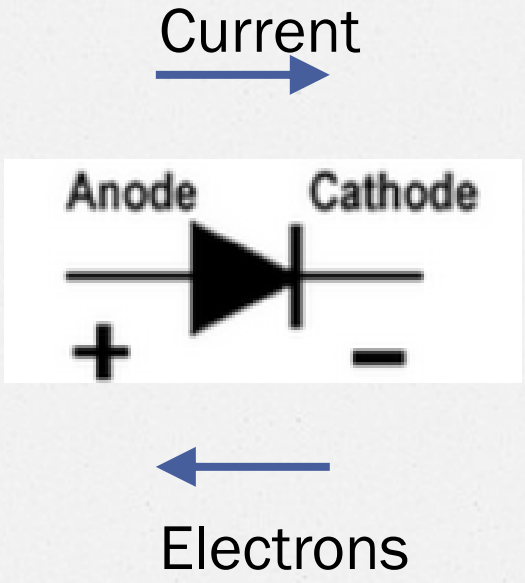
Current

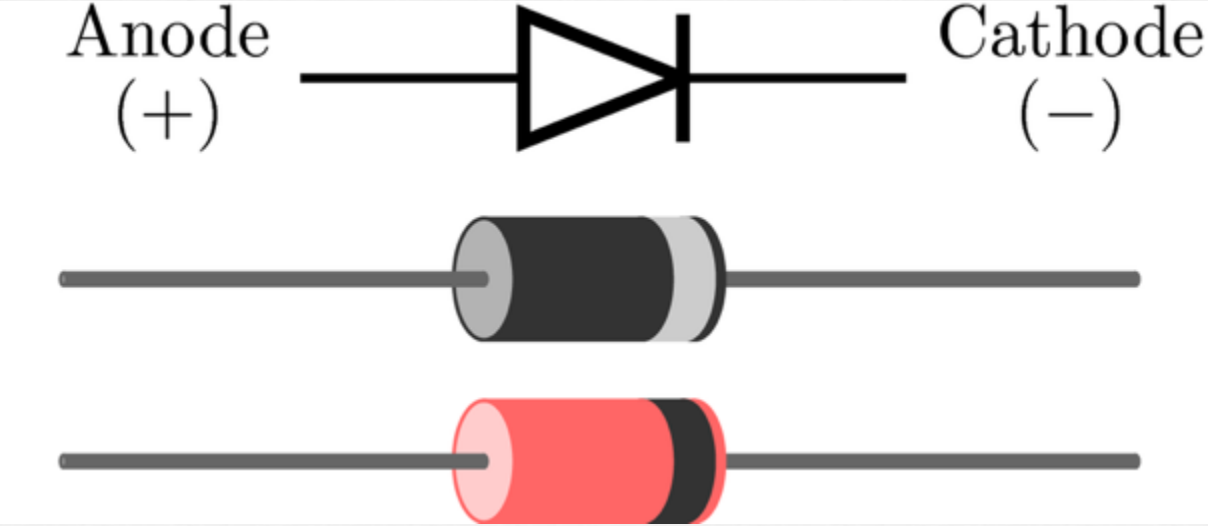


Electrons

ACID:

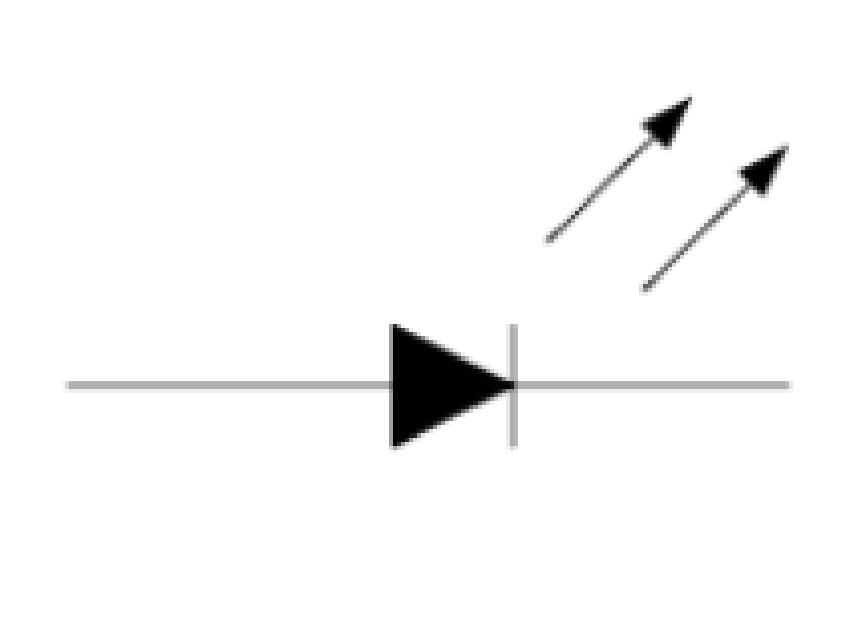
Anode
Current
Into
Device

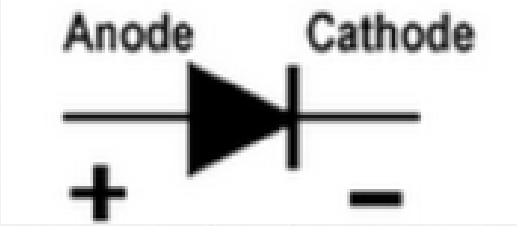


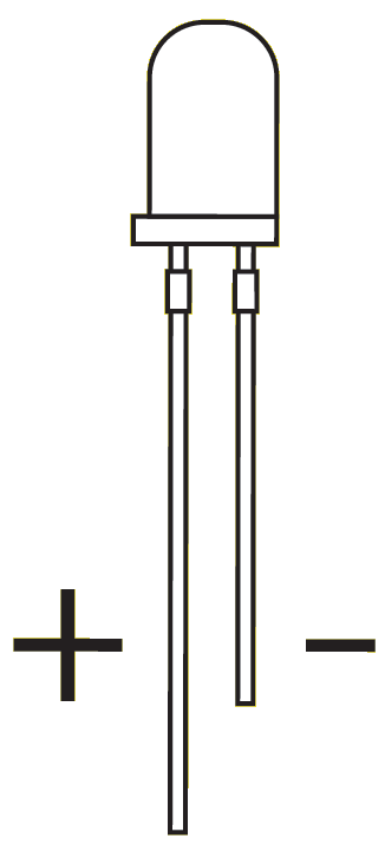

Anode
(+)
Cathode
(−)

Light Emitting Diode

Same as diode but also releases energy (as light)

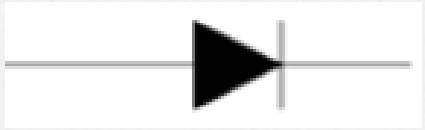




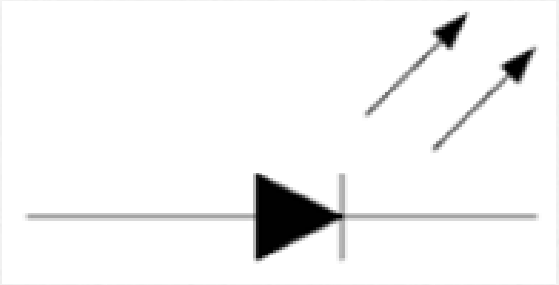


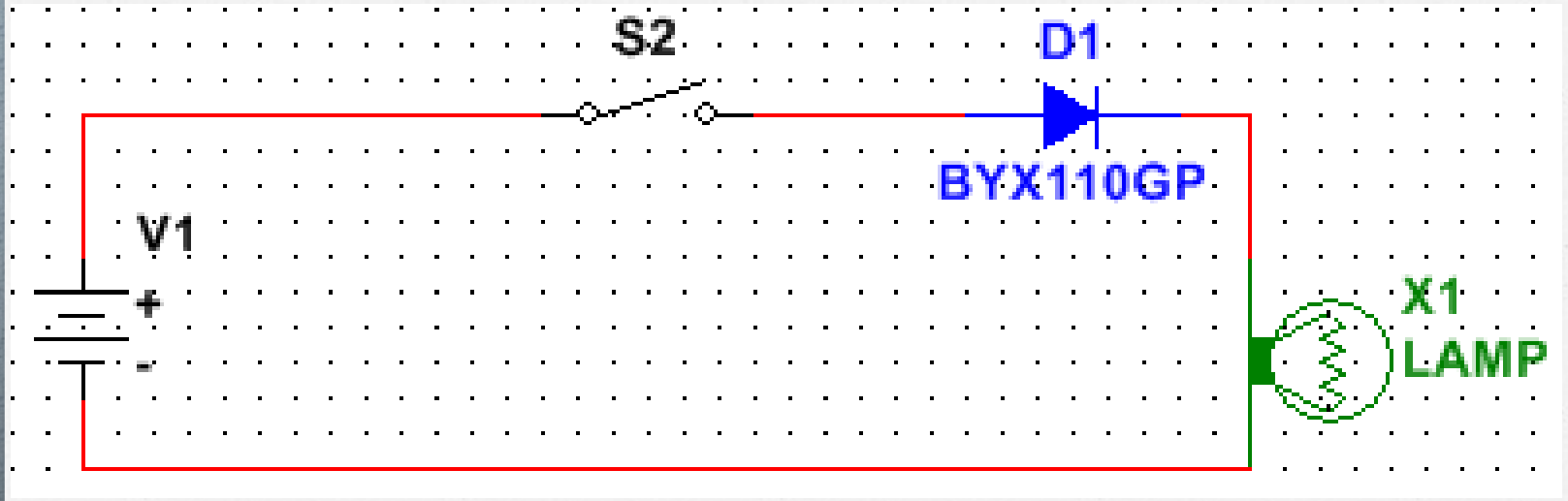
Just like battery, the (+) side is longer

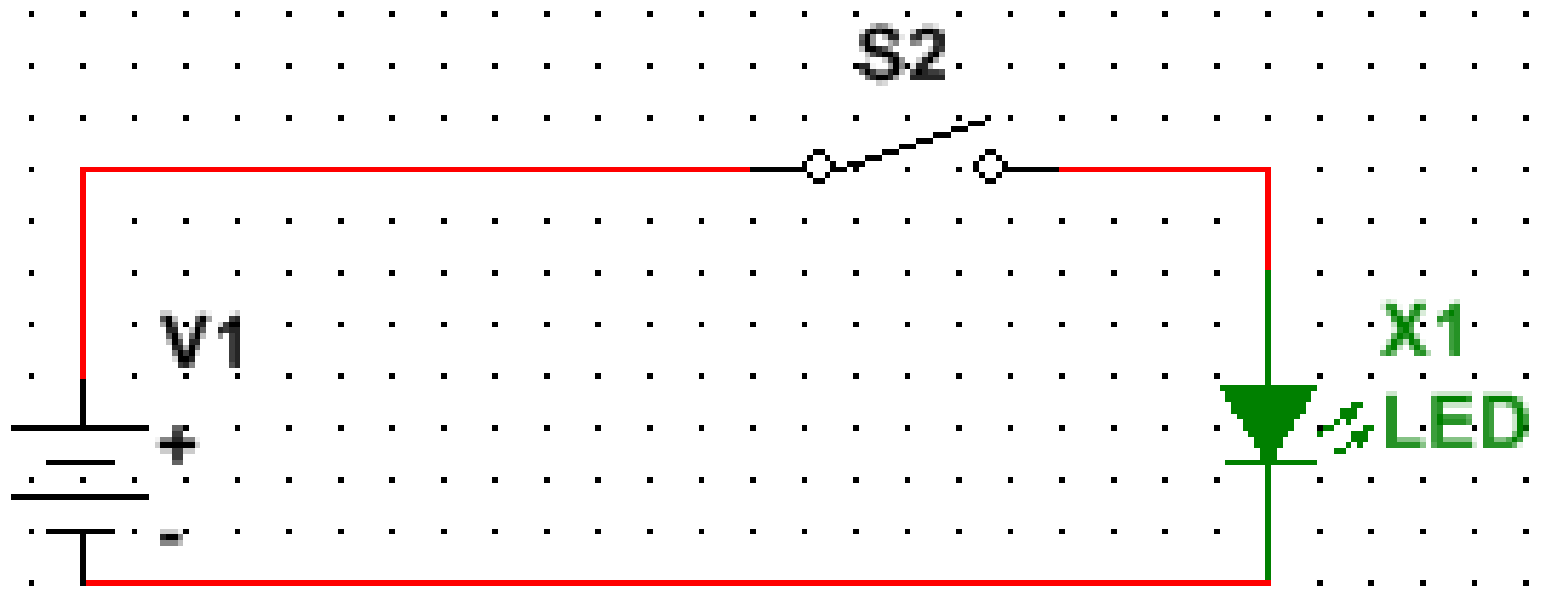
Diode



LED

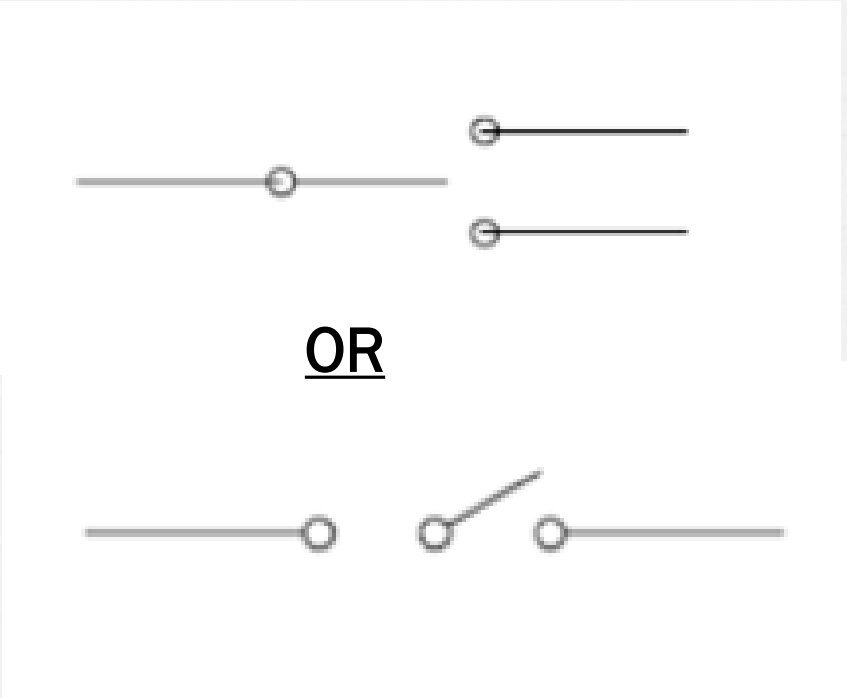



S2
D1
BYX110GP
V1
+
-
X1
LAMP


S2
V1
+
-
X1
LED

Review Switches

SPDT switch

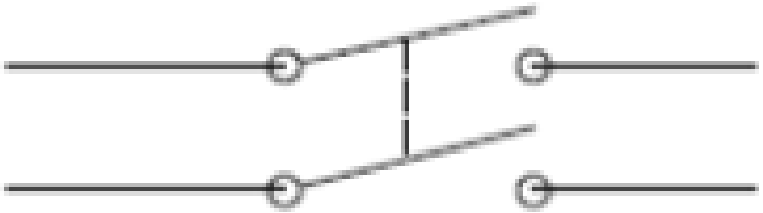


Single **P**ole **D**ouble **T**hrow

One pole in the middle

It has *two* options for where to connect (double throw)

DPST switch

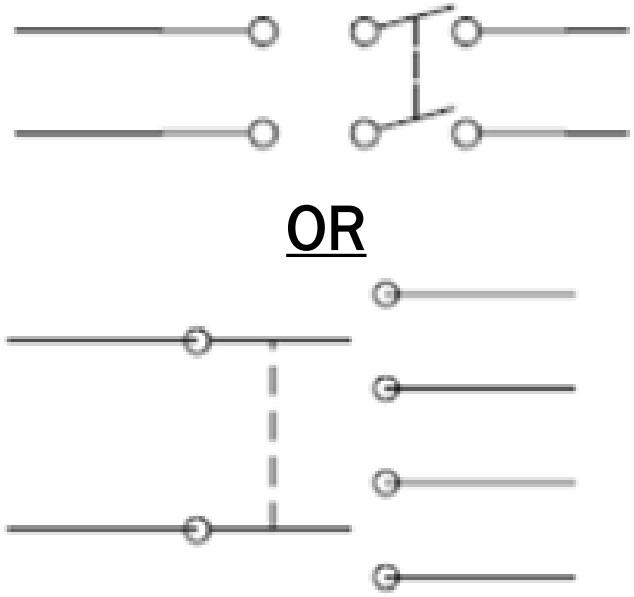


Double Pole Single Throw

TWO poles!
But each pole only has place to go (single throw)

Looks like two SPST switches glued together

DPDT switch



OR

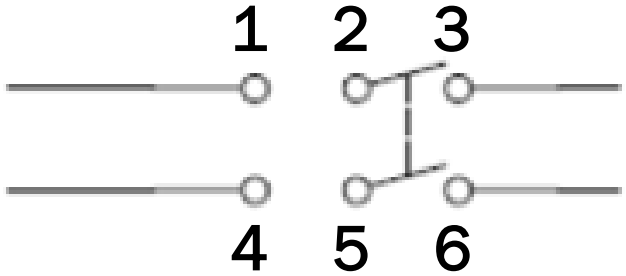
Double Pole Double Throw

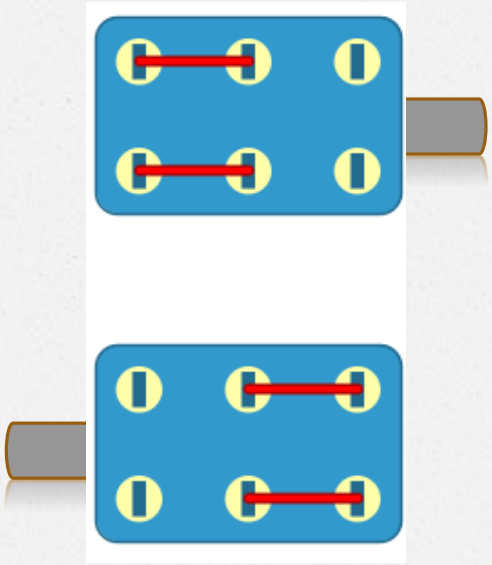
Two poles again

Each pole has TWO options for where to connect (double throw)

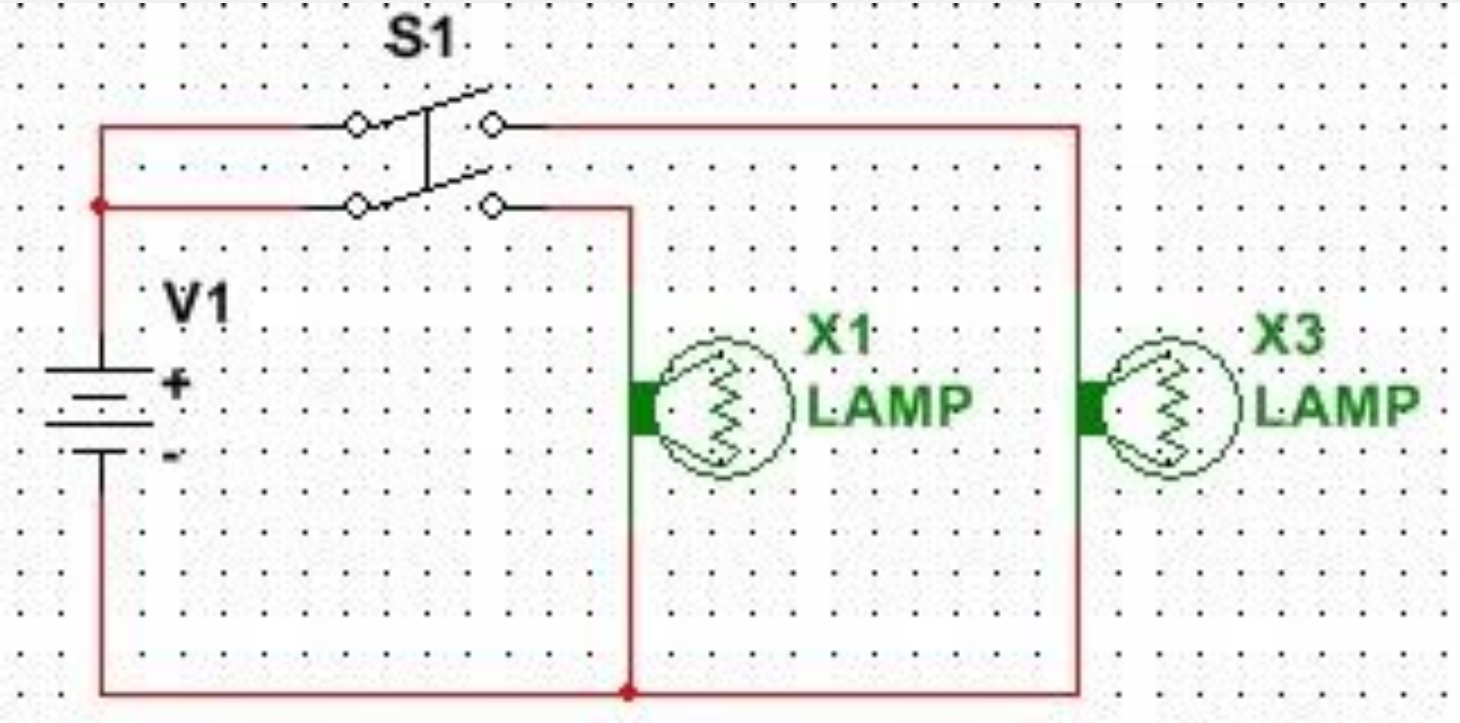
Looks like two SPDT switches glued together

DPDT switch





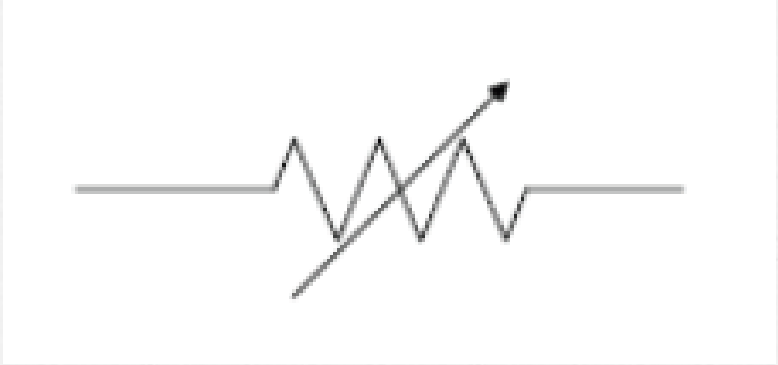
Practice Practice Practice…


S1
V1
+
-
X1
LAMP
X3
LAMP

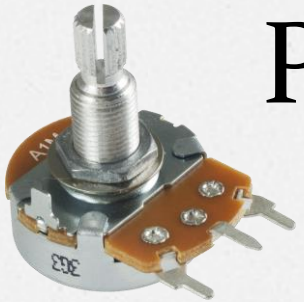
Variable Resistor

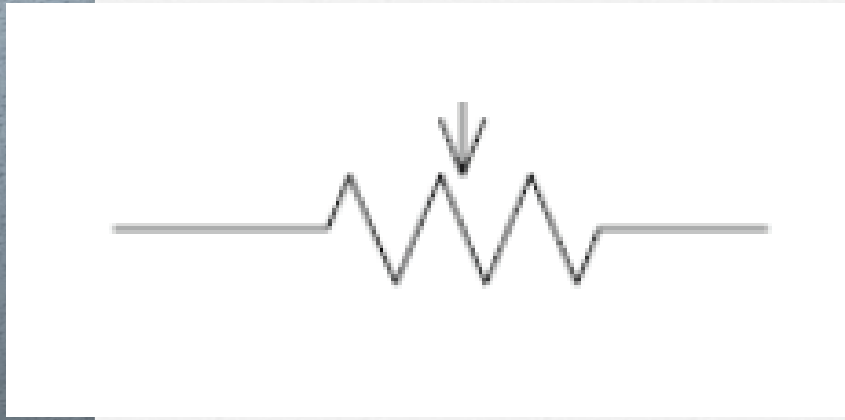
Normal resistor whose resistance can be changed.

Example use: “dimmer” switch



Potentiometer

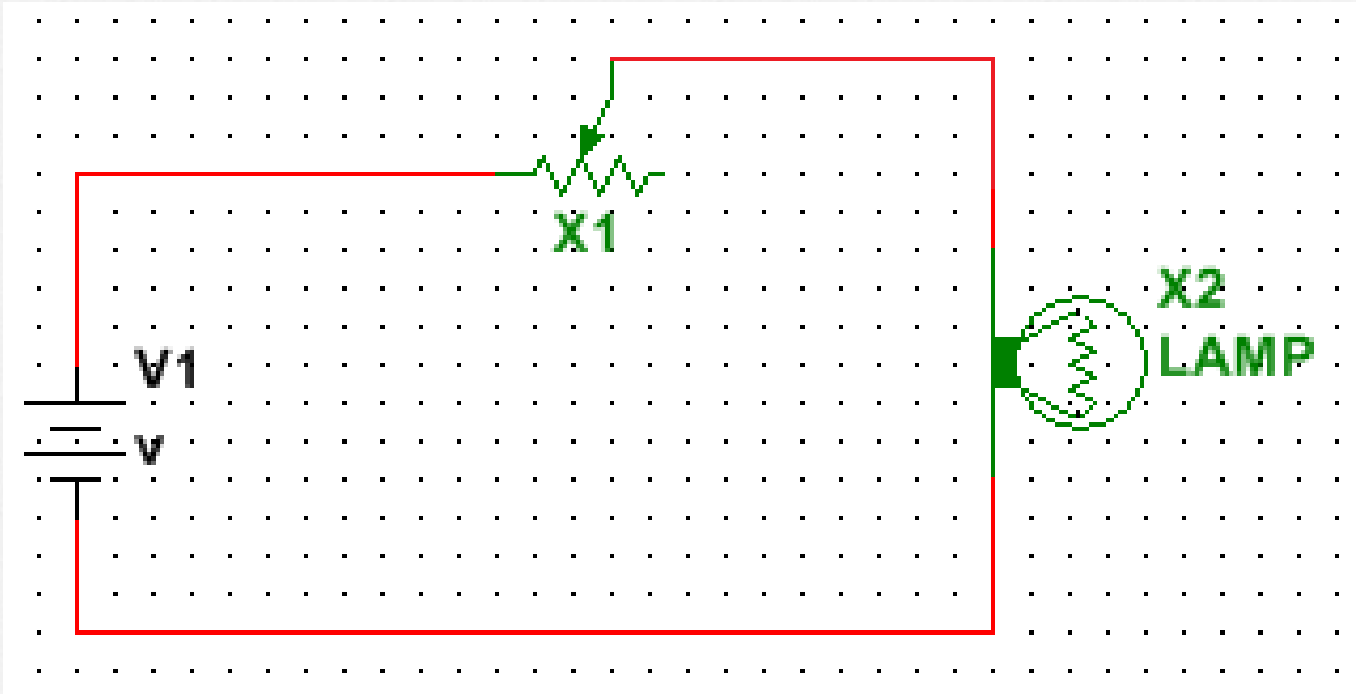


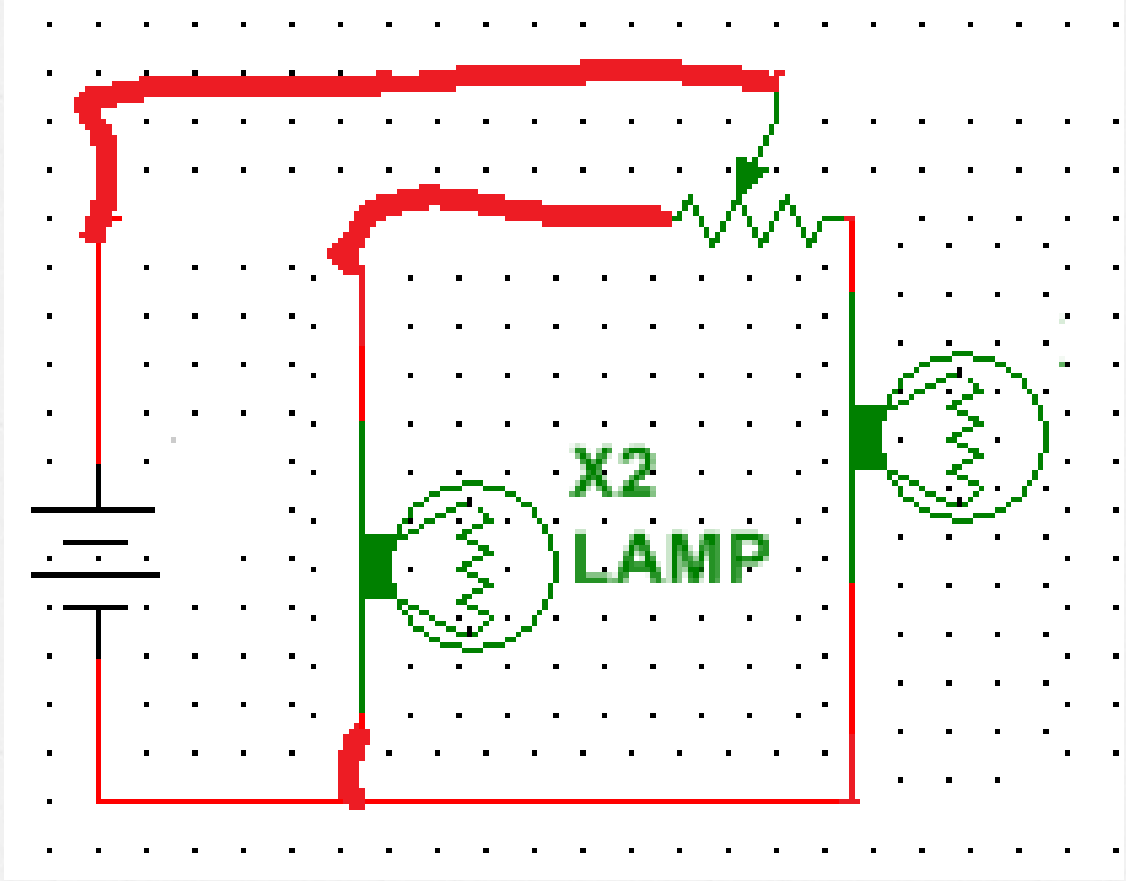


A resistor with a movable “tap” in the middle.

Example use: “voltage divider”

Note: pots can be used as variable resistors (think how?)


X1
X2
LAMP
V1
V


X2
LAMP

Measurment

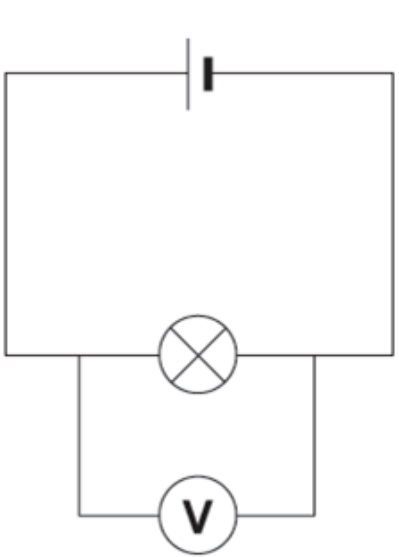
DMM

Digital Multi Meter

Can measure voltage and current

DMM

Digital **M**ulti **M**eter
Can measure voltage and current

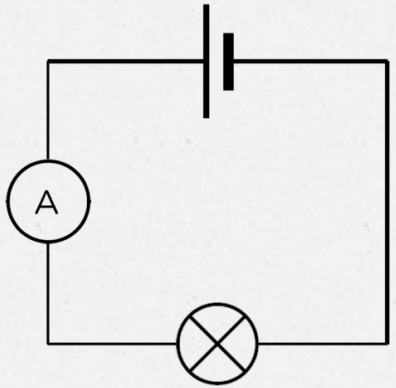


Voltage measurements must be done *in parallel*

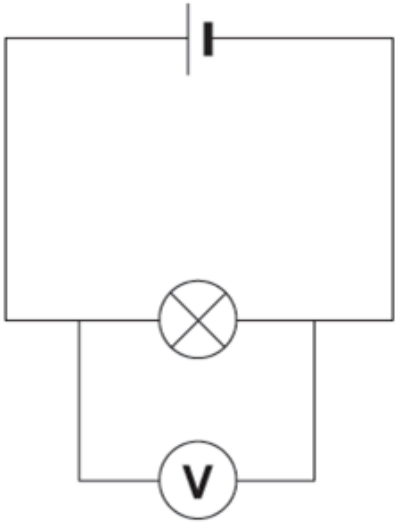
DMM

Digital **M**ulti **M**eter
Can measure voltage and current

Current measurements must be done *in series*



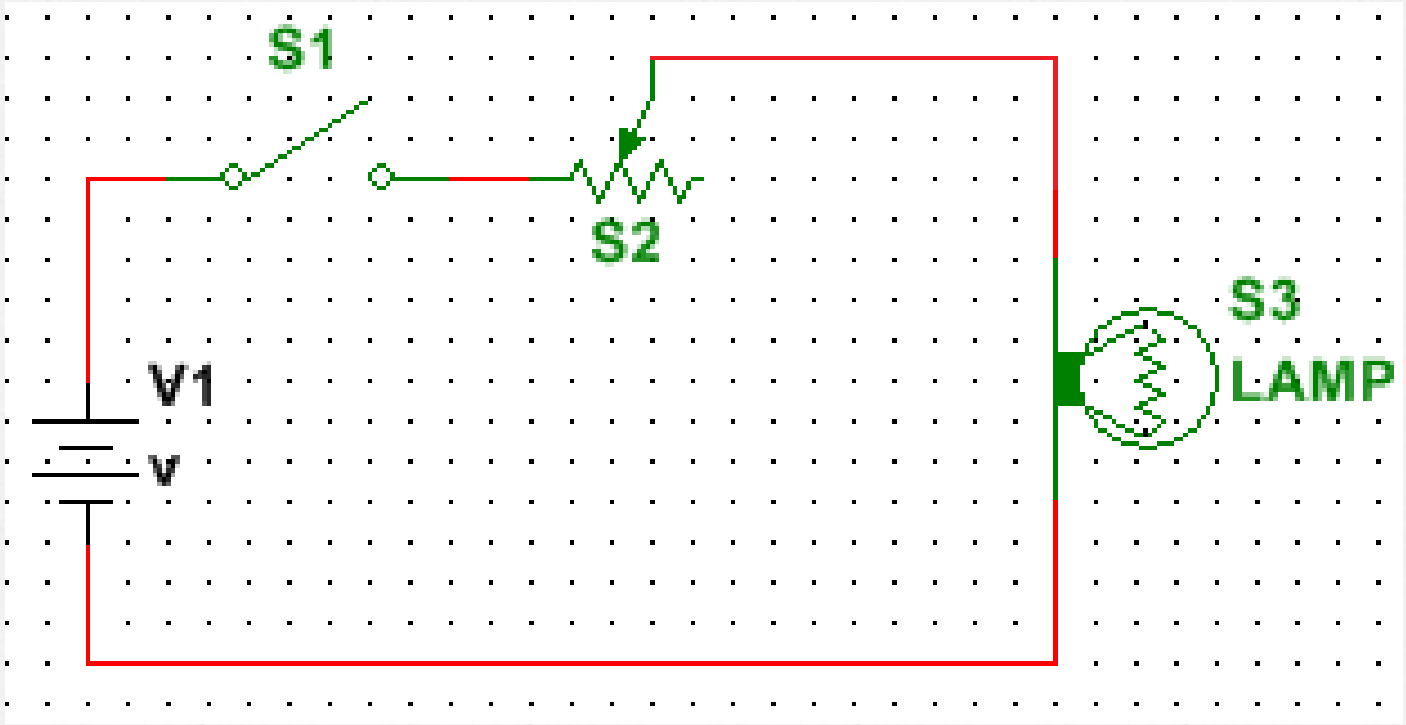
Voltage measurements must be done *in parallel*



DMM

Make sure to use the right setting
(A=amps, V=voltage, …)
Don't use the "squiggly" line settings (they are for AC circuits)

Also use to the right terminals
Always connect one lead to COM (short for common)

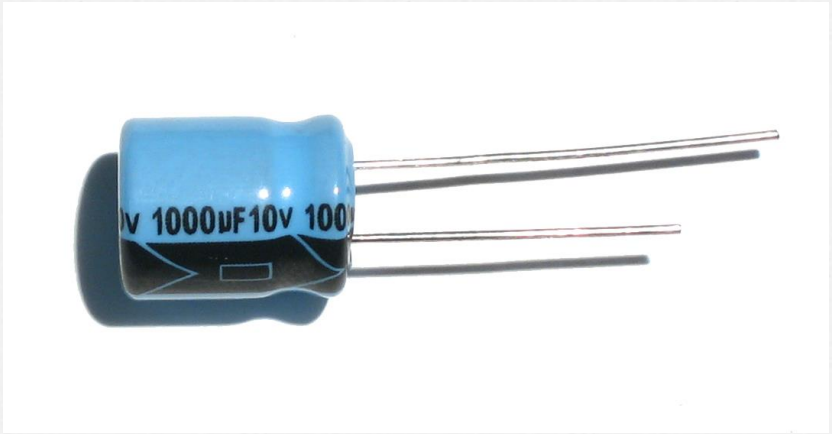

S1
S2
S3
LAMP
V1
V

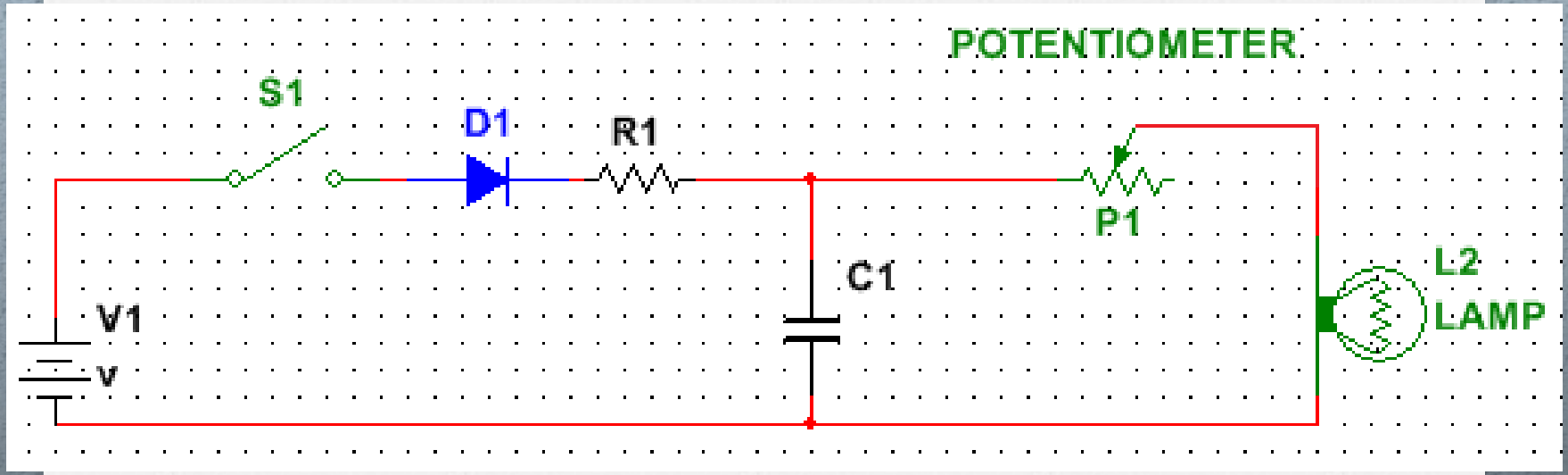
CAPACITORS ARE NOT INCLDED IN CIRCUIT WIZARDRY 2025

Capacitor

OR

Stores energy - it's like a temporary battery



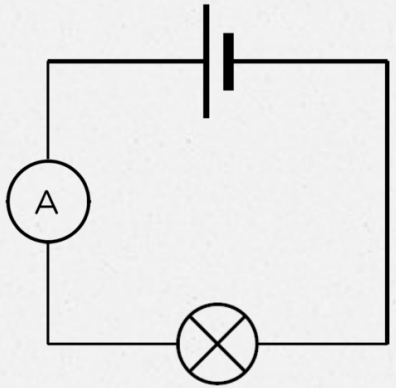

POTENTIOMETER
S1
D1
R1
P1
C1
L2
LAMP
V1
V

Flashcards

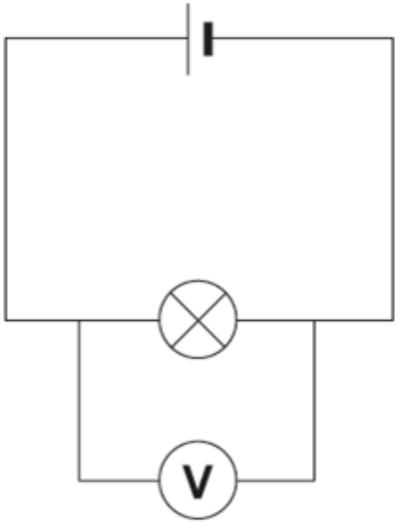
DMM

Digital **M**ulti **M**eter
Can measure voltage and current

Current measurements must be done *in series*



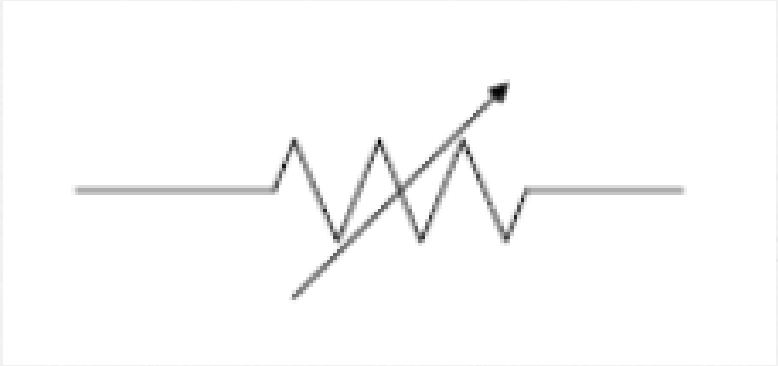
Voltage measurements must be done *in parallel*



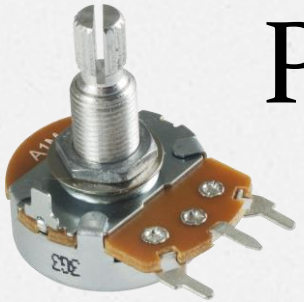
Variable Resistor

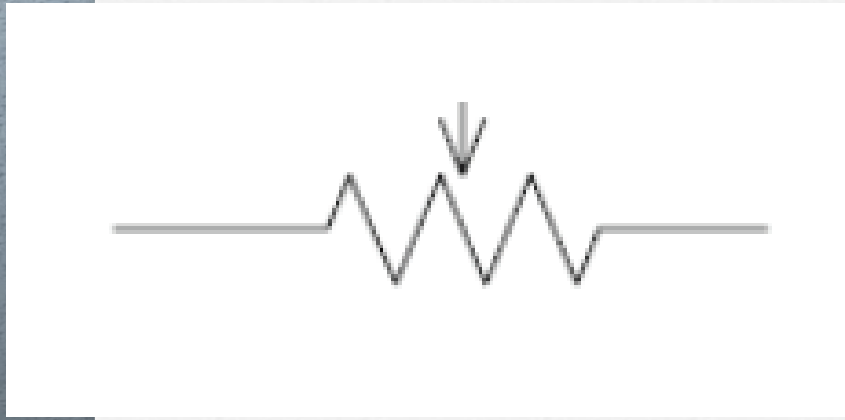
Normal resistor whose resistance can be changed.

Example use: “dimmer” switch



Potentiometer





A resistor with a movable “tap” in the middle.

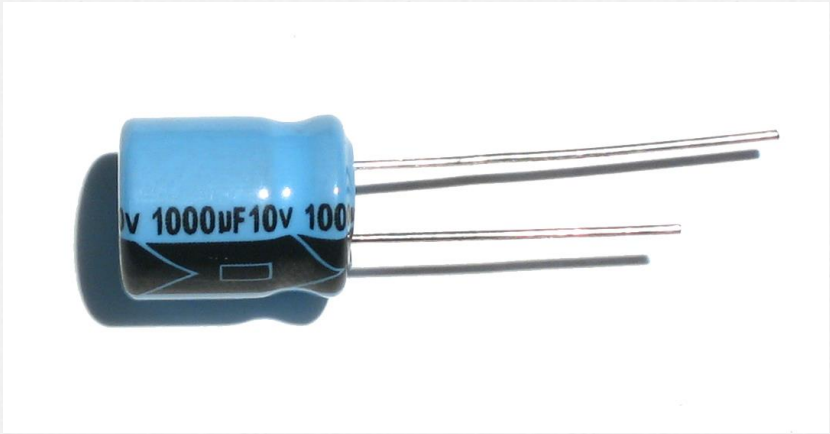
Example use: “voltage divider”

Note: pots can be used as variable resistors (think how?)

Capacitor

OR

Stores energy - it's like a temporary battery



To do at home :)

Make sure to:

Memorize flashcards
Build more circuits (start with the ones in this slideshow then be creative and build your own)

Check out these cool videos/apps:

Link #1 – Another Circuit Builder (this one shows voltage and current)
Link #2 – Falstad Circuit Builder (fairly advanced, it will make more sense after each workshop)
Link #3 – C is for Capacitor