

Circuits and Breadboards

Circuit... Circle of current

Conventional current **positive to negative**,

Breadboard

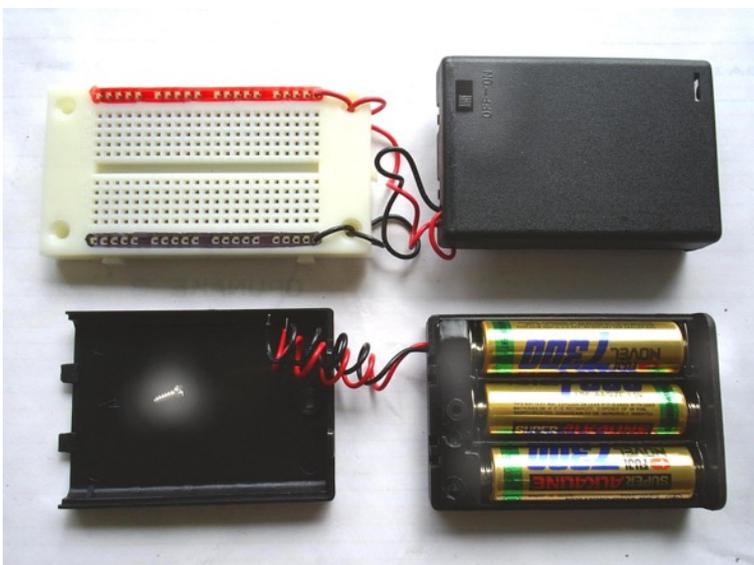
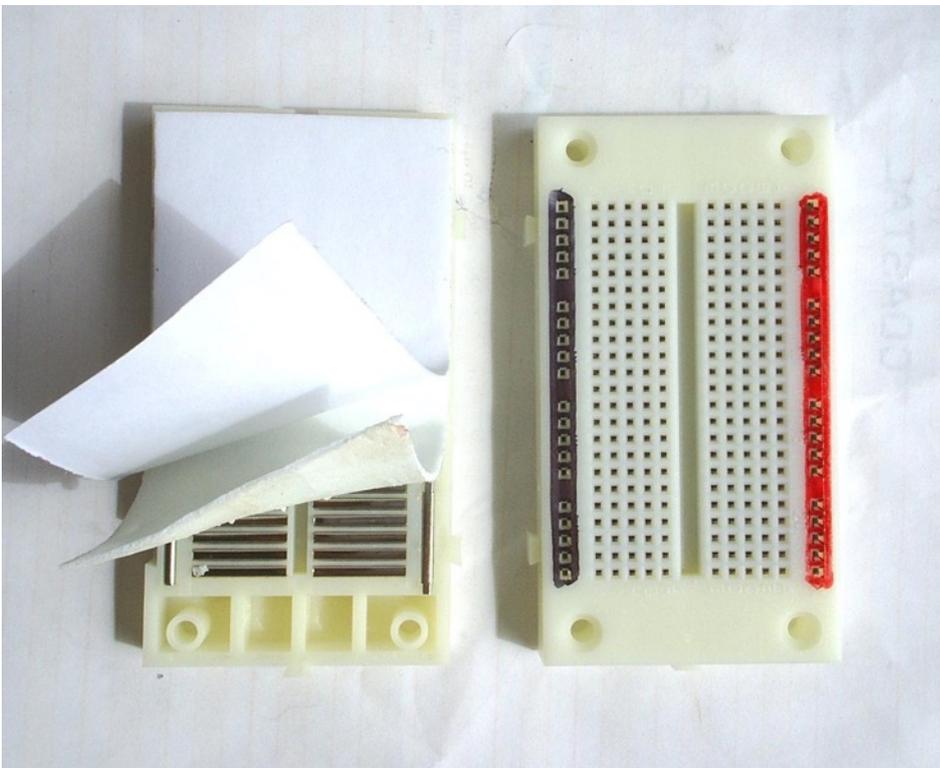
Used for testing/prototyping circuits,

Orientation:

Outside power supply bus strips, inside terminal strips, center divide

Rows and Columns A to J, 1-20

How to insert LEDs and resistors into breadboard, hold close to the end



Breadboard Power Supply

Question $3 \times 1.5 \text{ volts} = 4.5$
volts **DC**

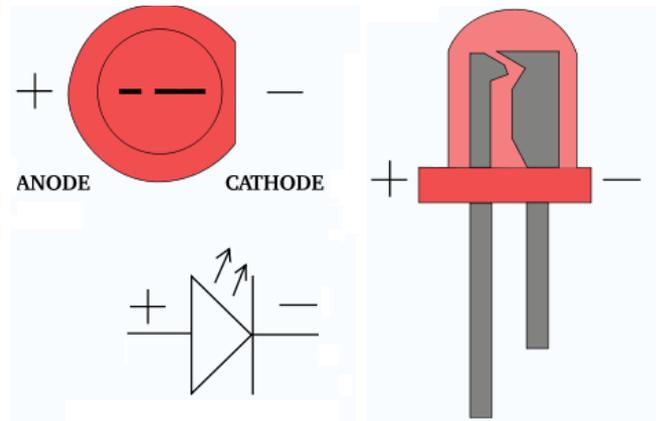
Conventional current **positive**
red to **negative** black
ON OFF switch

Power supply, max voltage
and current,

LEDs:

DC, **polarised**, colours have different **max voltage and current**

red LEDs = 2.2 volts and max 25 milli amps



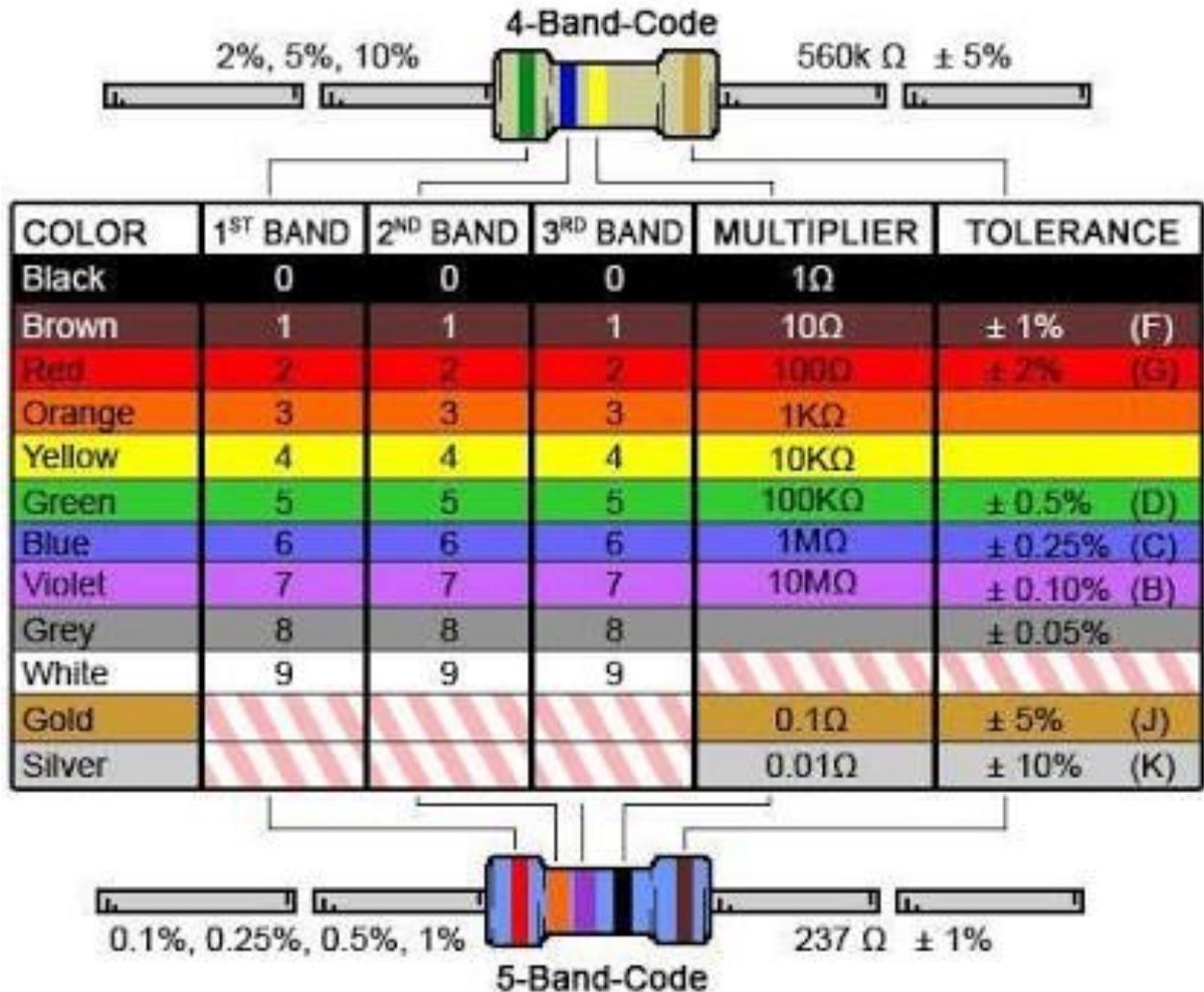
RESISTORS:

Resistors measured in **Ohms**,

Resist electricity, more ohms equals less electricity (current).

non polarised

Variable Resistor, sensors **LDRs** (light dependent resistor), **Thermistor** (temperature dependent resistor)



Activity: Solder-less Breadboard, LED Resistor circuit

Materials

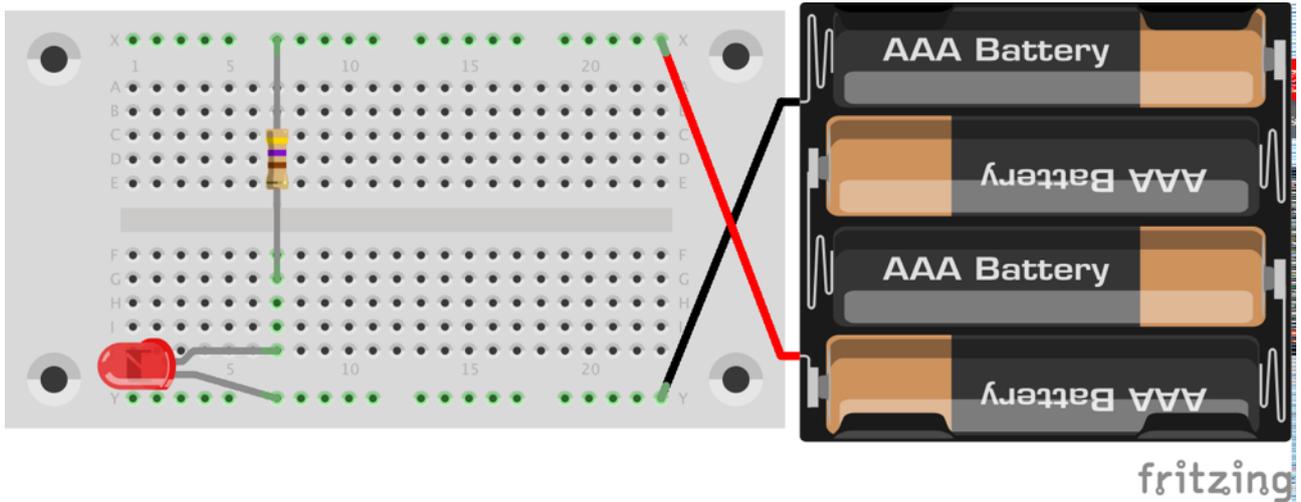
Breadboard, power supply 3 - 4.5V, 220-460 ohm resistor, LED

Key Knowledge

Why do we use a resistor with the LED?

Polarities of components

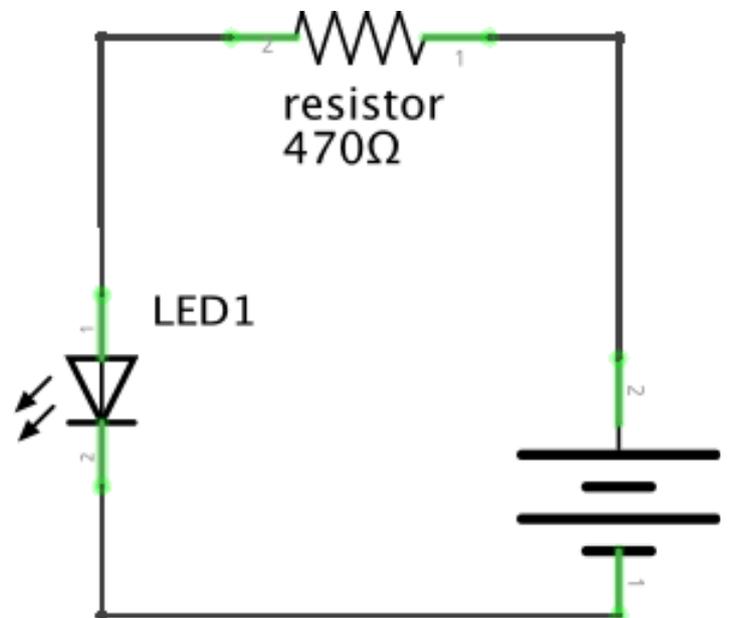
Circuit



DEBUG

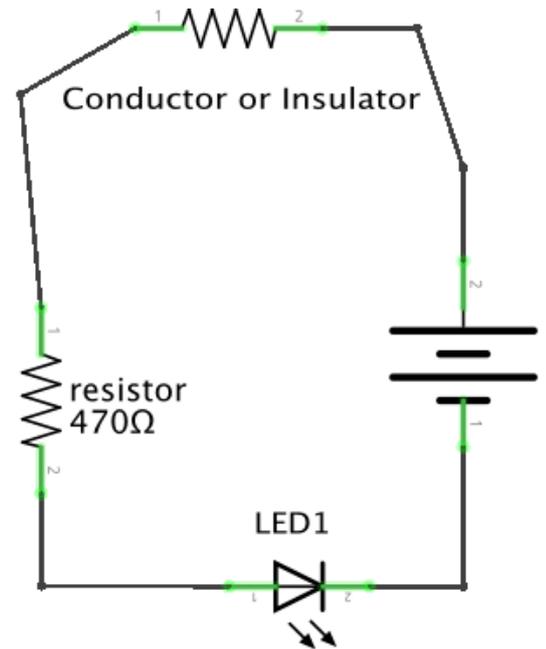
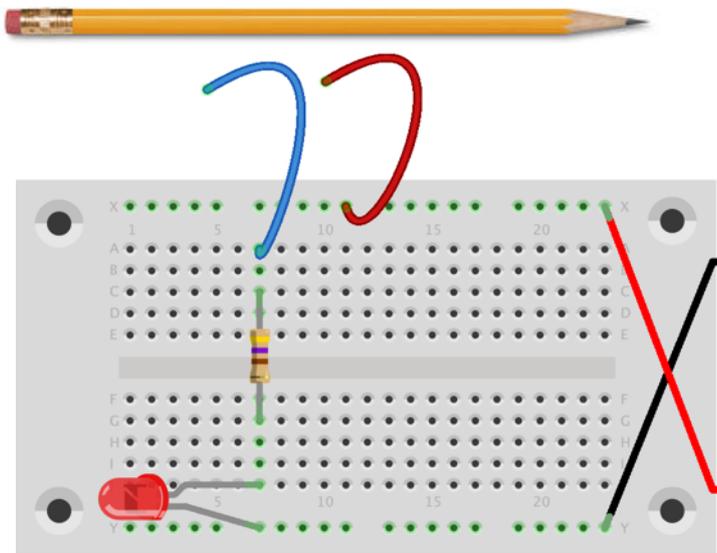
If LED isn't glowing then DEBUG circuit!!!

- Is the power on? Are batteries the correct way round?
- Check all components are inserted into breadboards and in correct place.
- Try a new LED



Activity: Conductivity Testing

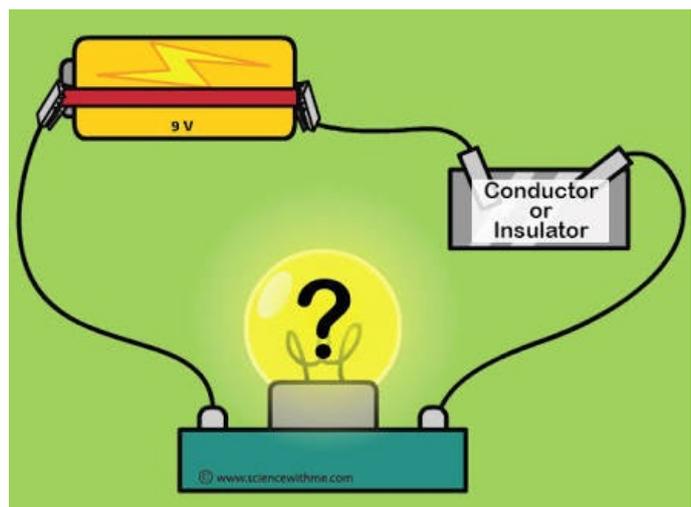
Test different materials to see how **RESISTANT** they are. Touch the two wires onto each end of a substance. Does the **LED** light up, Even a little bit? Is it a **Conductor or Insulator**?



Conductors and Insulators

Insulators do not let electrons flow very easily from one atom to another. Insulators are materials whose atoms have tightly bound electrons. These electrons are not free to roam around and be shared by neighboring atoms.

Some common **insulator** materials are glass, plastic, rubber, air, and wood.



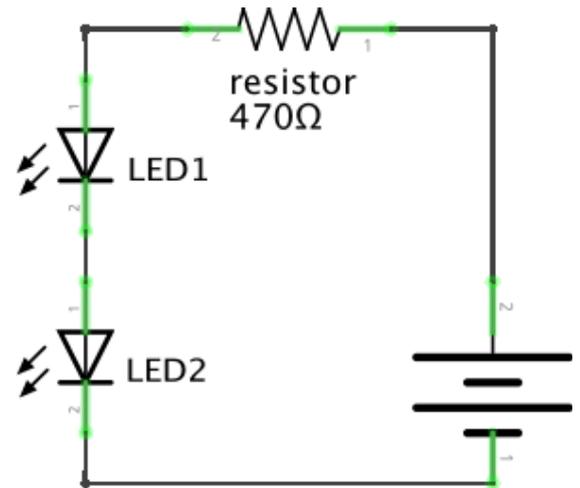
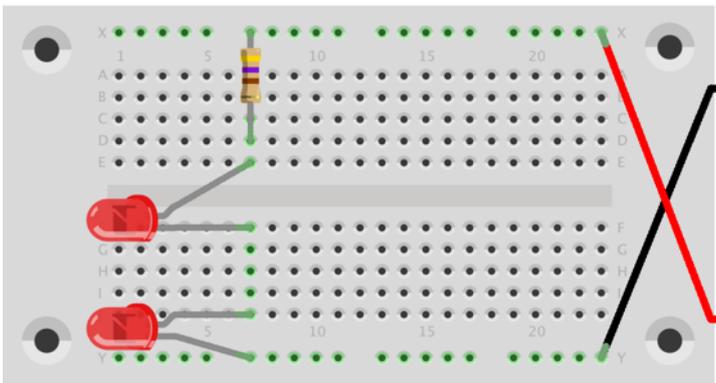
Conductors let the electron current or flow of electrons move through them easily. Most metals are considered to be good conductors of electrical current, especially gold, silver, copper and aluminium.

Series and Parallel Circuits

Batteries in a **Series**, add voltages of each battery to find out **supply voltage**
Batteries in **Parallel** have the voltage of one battery

Activity: Make an LED Resistor in Series and Parallel.

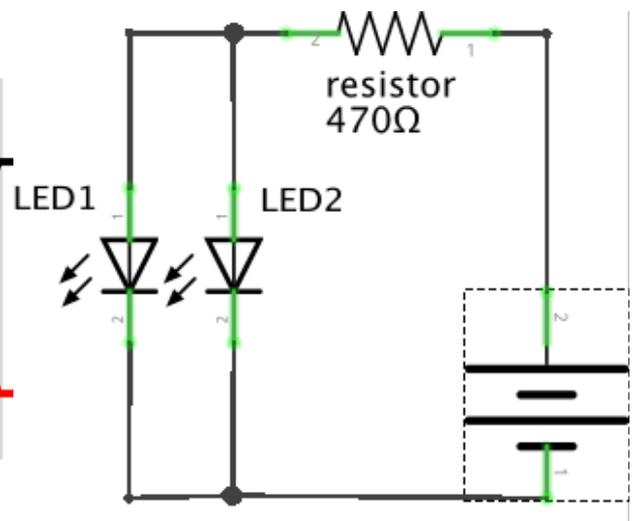
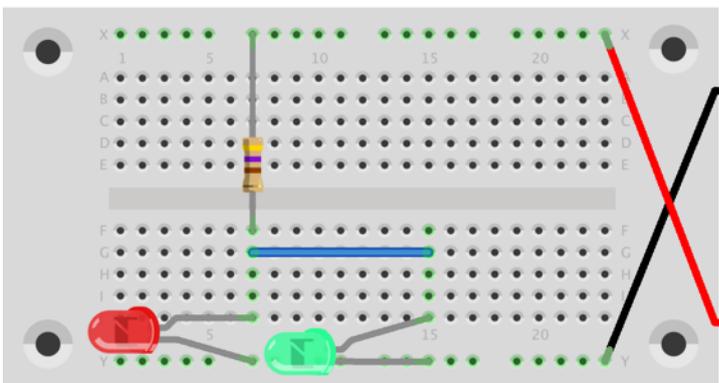
Two LEDs in series



Questions

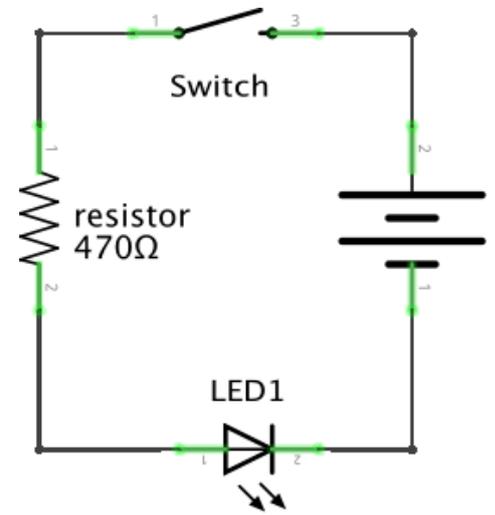
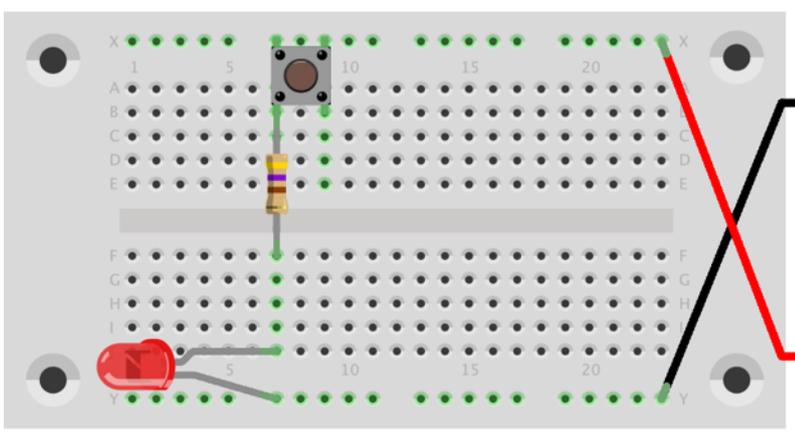
Which circuit makes the LEDs glow brighter, Series or Parallel ?

Two LEDs in Parallel



Switches, Open and Closed Circuits

Activity: Make an LED Resistor circuit with a switch in it.



Questions:

Is the switch DEFAULT position ON or OFF?

Information:

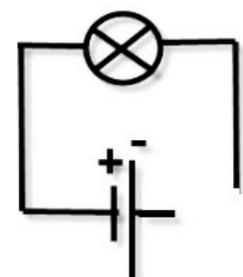
An **Open circuit** has a break where electricity cannot flow through.

A **Switch** changes the circuit to **open or closed**

Open Electric Circuit



Picture Diagram

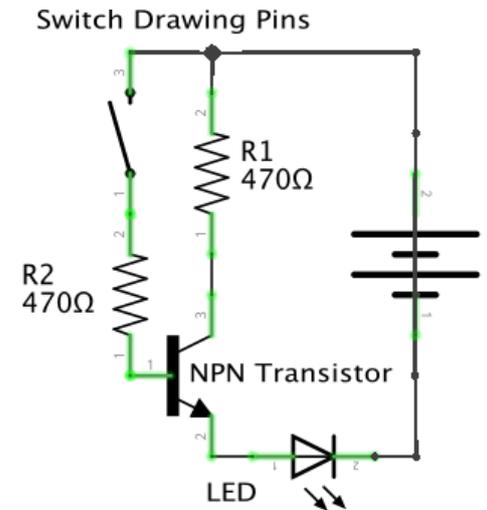
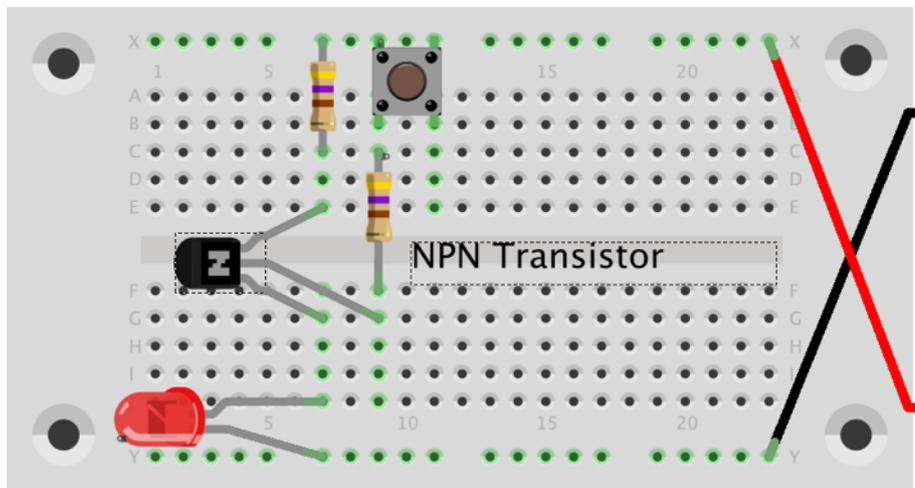


Symbol Diagram

Transistor, Electrical Switch

Activity: Make a circuit using a transistor to switch on an LED

Use a pushbutton switch or two Drawing Pins to make a switch you can close with your finger.



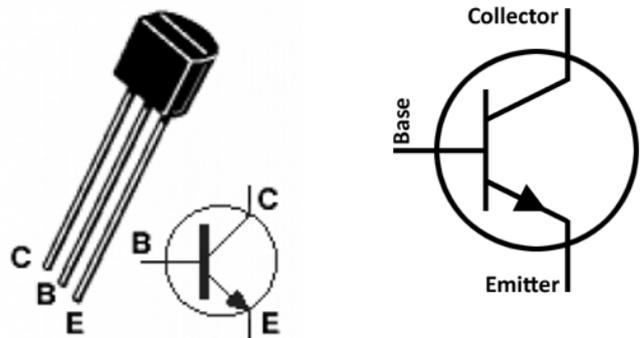
Questions:

Does the LED glow when the switch is set to off?

If you put a **jumper wire** between R1 and the LED (short circuit the transistor), would the LED glow brighter?

Information:

The **NPN Transistor** middle pin (**Base pin**) acts as a switch. When it has a voltage supplied to it, the connection between the two outside pins **Collector** and **Emitter** is closed.

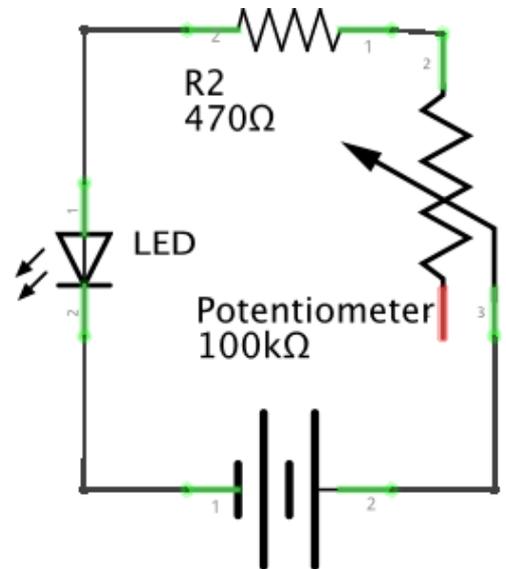
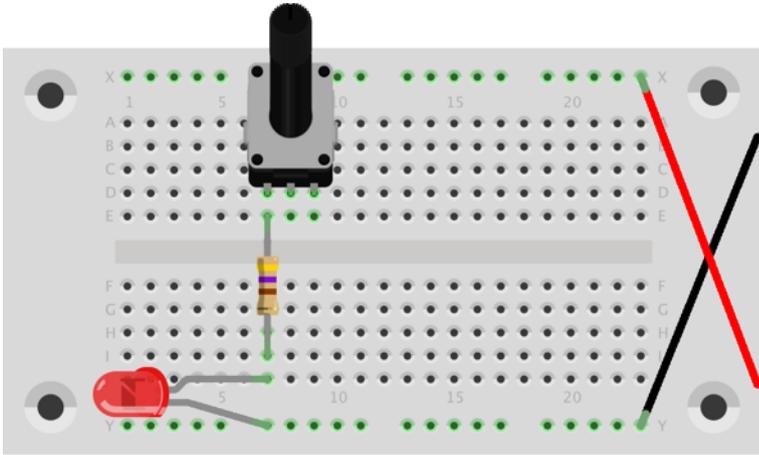


The voltage needed by the base pin to turn on the transistor is less than the voltage that comes out of the Emitter.

Transistors can act as switches and amplifiers.

Variable Resistors, Potentiometers

Activity: Make a circuit using a Variable Resistor to change an LEDs brightness.

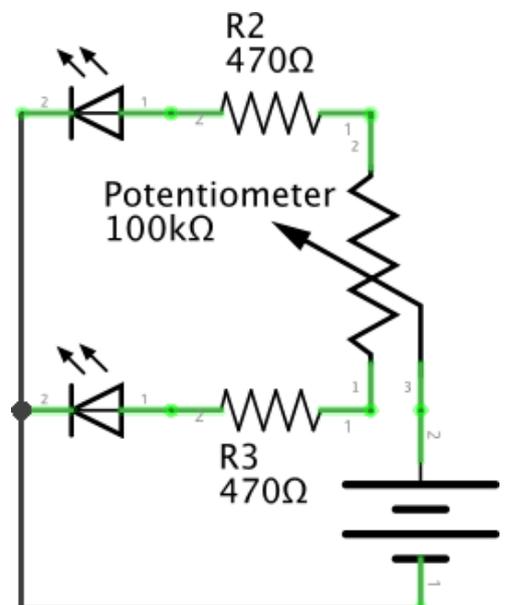
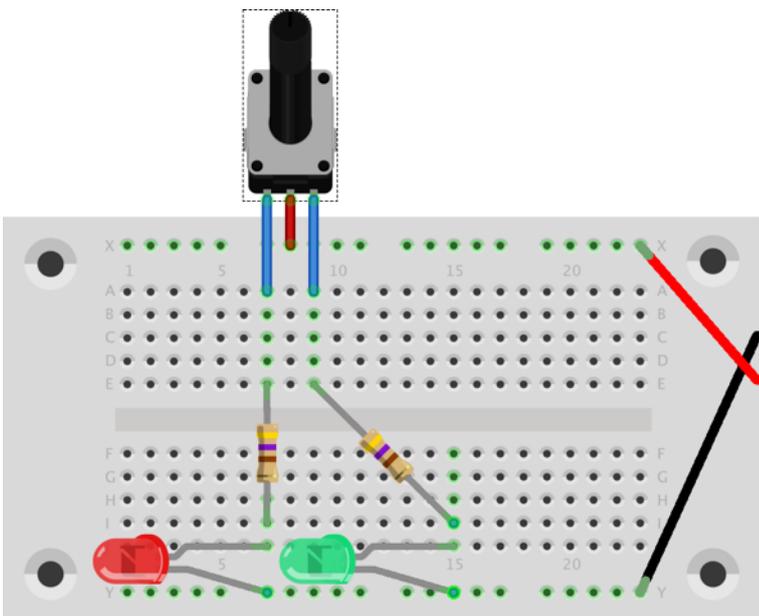


Questions:

At what point does turning the **Variable Resistor** increase the brightness of the LED?

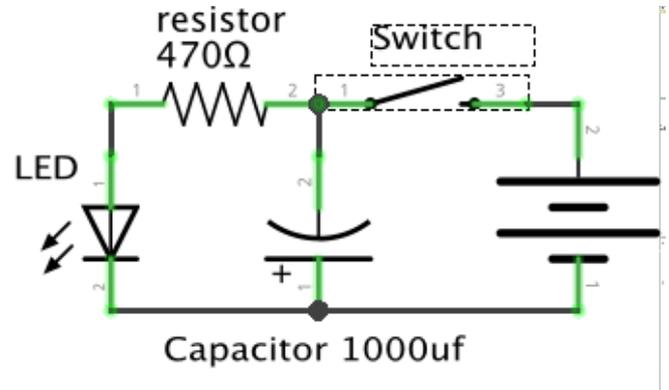
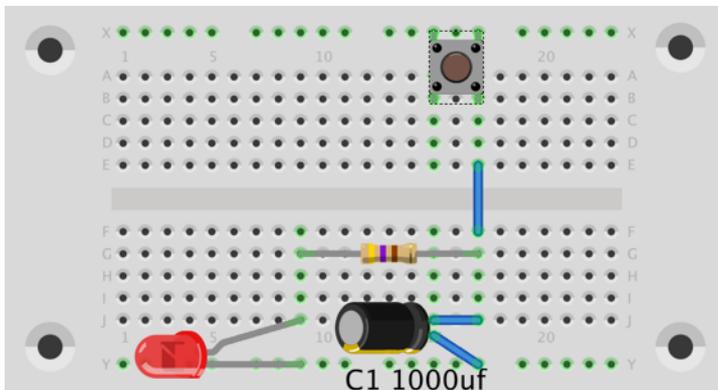
Why **doesn't** the LED get brighter near the middle of turning the variable Resistor?

Activity: Make a circuit using a **Potentiometer** to change two LEDs brightness.



Capacitors

Activity: Make a parallel circuit using a 470-1000uf **Capacitor** and an LED.

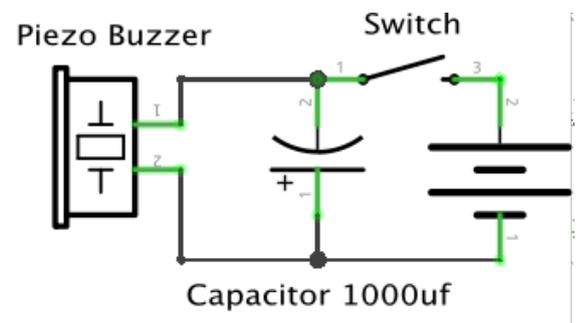
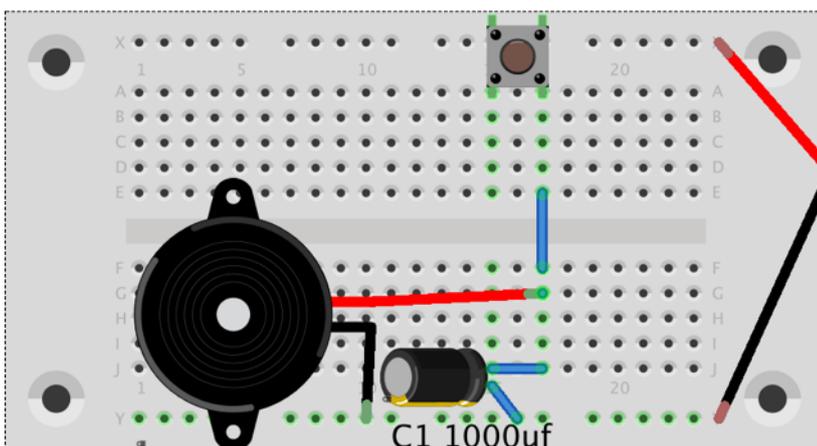


Questions:

What happens when the switch made open?

What is the Capacitor doing when the switch is turned off?

Activity: Make a parallel circuit using a **Capacitor** and a **Piezo Buzzer**.



Questions:

What does it sound like as the Capacitor is running out of electrical charge.

What other component is a Capacitor like?

How noisy is too noisy!