# CS 257 Lesson 2
Activity 2: Using Transistors
Working with solid state switches

Introducing Transistors

Transistors are semi-conductor devices that have three leads. When a small voltage is applied to the "Base", the transistor turns on and allows current to flow through its "Collector" and it's "Emitter". Transistors make up the majority circuits inside a CPU or integrated circuit. That is why it is important to understand how they work.

Figure 1- LED is OFF

In our first activity with transistors, we will use one of them to turn our LED on/off. Look at figure 1. In this schematic we are using a 5 Volt battery. The B+ is connected to our LED through a 470 ohm current-limiter resistor. The switch is open so no current flows. The transistor is connected to the switch through a 10K ohm resistor which is connected to its BASE. This 10K resistor will supply voltage to the transistor when the switch is closed.

Figure 2- LED is ON
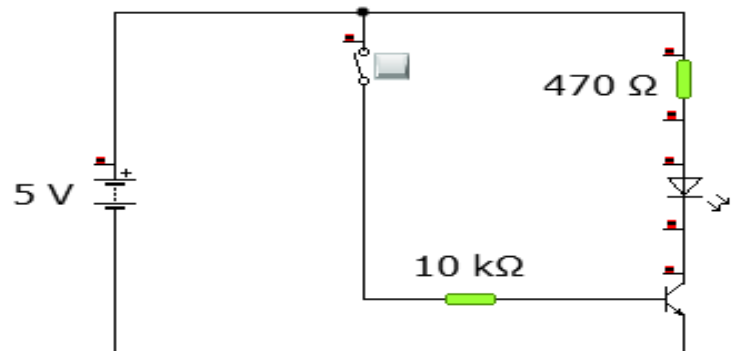
In Figure 2, we can see that the LED can only glow when current flows through the collector and emitter of our transistor to ground. The emitter is the leg shown by the arrow and is connected to ground (B-). When the switch is closed, current flows to the base and turns the transistor on. Once turned on, it lets the current flow from collector to the emitter and ground. This completes the circuit and the LED lights up.
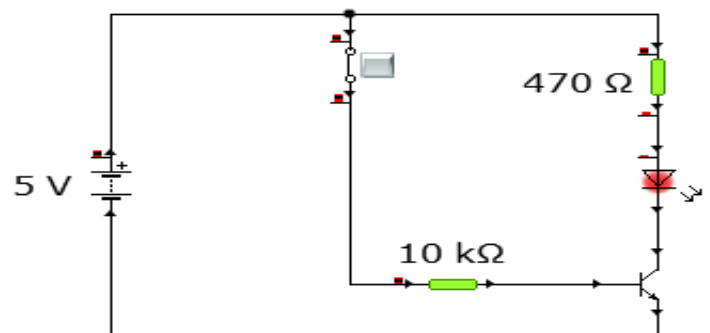
 Notice how similar this circuit is to our original LED circuit we built shown on the right. The LED is connected to ground via a wire. Not a transistor.

The question is, why are we going to all this trouble just to light an LED when it worked fine without a transistor? Well, when you want to
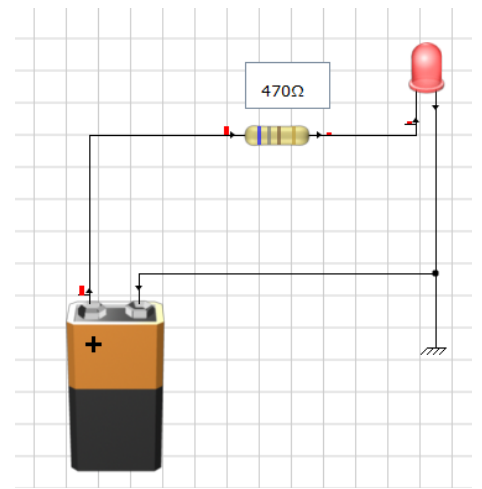
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control a lamp or motor, or some other device that requires a lot of current, you need some help.

Eventually, we will use a Basic Stamp (BS2) microcontroller to turn our LED on and off at precise intervals. The trouble is that the BS2 can only produce about 20mA of current to turn circuits on. If our circuits require more than that, it could burn out the BS2. Consequently, we need to use another device to help us. The transistor is the first device I will introduce you to that can handle more current than a microcontroller alone. The second device is called a relay. We will see how to use relays in numerous and useful ways later.