Simple Circuits

Before You Begin

Answer each of the following questions related to this unit's global context: *Orientation in Space & Time*.

GLOBAL CONTEXT (Orientation in Space & Time)
Imagine you were living during a time *without* electricity. How much of your current lifestyle would be different? How much would be the same?
In what ways has access to electricity and electronic devices shaped who you are?
The statement of inquiry for this unit is *the invention of electricity and electronics was a turning point in the history of human development*. Do you agree with this statement? Why or why not?

Technical Background

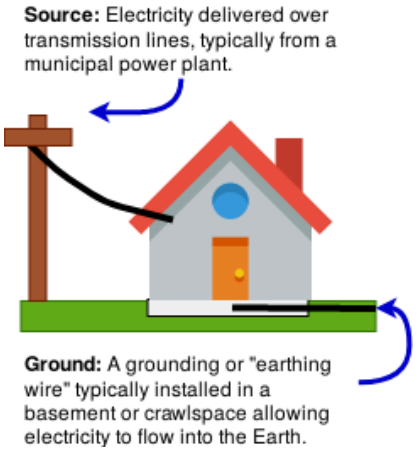
While a full understanding of electricity is beyond the scope of this course, a basic understanding of some terminology and components is required to understand the technical skills you will be developing. Below is a very simple overview to get us started.

Electrical Circuits

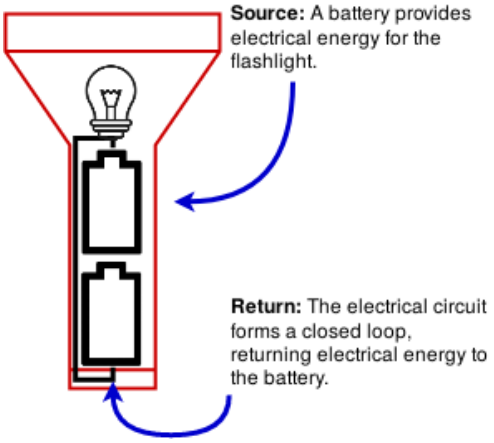
DEFINITIONS	
Electrical Circuit	An *electrical circuit* is any path from a *source* of electricity to a *ground*.
Source	A *source* is anything that provides electrical energy, such as power plant, solar panels, or a battery.
Ground / Return	The *ground* or *return* in an electrical circuit is the destination for electrical energy.

Examples

Here are a few examples of common electrical circuits.



A simple home electrical circuit.



The electrical circuit in a flashlight.

Of course, electrical circuits are not that interesting if they don't *do* anything. This is where the concept of a *load* comes into play.

Load	A *load* in an electrical circuit is anything that consumes electrical energy to produce some result.

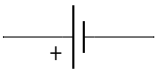
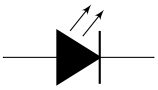
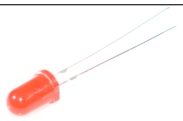
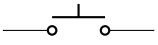
ATL SKILL (Communication Skills)

...make inferences and draw conclusions...

Q1 Briefly describe the *loads* typical to the two electrical circuits given above.

Simple Components

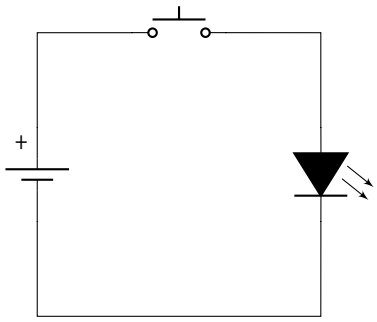
We are going to build a few simple circuits to explore electricity and its various applications. Here is a list of the components we will need for this first lesson.

Name	Description	Symbol	Example
Coin Battery	A *coin battery* works just like a battery you're probably already familiar with such as the typical AA or AAA batteries, except its shape resembles a coin. These batteries typically provide 3 volts of electrical energy. The image on the right is of a common CR2032, named because it has a diameter of 20mm and a thickness of 3.2mm.		
Light-Emitting Diode (LED)	A *light-emitting diode*, or LED, is a typical light source in electronic circuits and many consumer devices. They are available in a wide variety of colours and sizes. The one shown on the right has a red lens with a diameter of 5mm. Note that an LED only allows electricity to flow in one direction, noted by the arrow in the symbol and, typically, a flat side of the lens and shorter leg.		
Push Button	A push button is a mechanical switch which "closes" or "opens" and electrical circuit. The ones included in your electronics kit are "normally-open, momentary" push buttons. This means that if you don't press them, the electrical circuit is open (normally-open), and a spring forces the button to return to its default position after you release it (momentary).		

Note that the symbols listed above will be useful when expressing circuits in circuit diagrams, explained below.

Circuit Diagrams

A circuit diagram uses symbols and lines to represent electrical circuits in a simplified way. Below is an example of a simple circuit diagram.



ATL SKILL (Communication Skills)
...use and interpret a range of discipline-specific terms and symbols...
Q2 Identify and label each of the components in the diagram on the left.
Q3 What do the lines show in a circuit diagram?

Note: You might have learned in Physics class that electricity is the flow of electrons from a source of negative potential to positive. This is called the "electron flow" model of electricity. However, this is an understanding of physics that is *newer* than the study of electrical circuits. In "conventional flow", we think of electricity as flowing from positive to negative.

All of the circuit diagrams you see in this course, as well as a majority of diagrams you'll find elsewhere, are written under the conventional flow assumption.

Developing Technical Skills

We will begin our exploration of electrical circuits by building *paper circuits*. These circuits are built by using conductive tape (typically a copper foil) placed on paper with other components placed appropriately on top of this tape and secured using normal cellophane tape.

Circuit #1

This is the simplest circuit we will work with, but will allow you to practice using the available materials for building paper cirtuics.

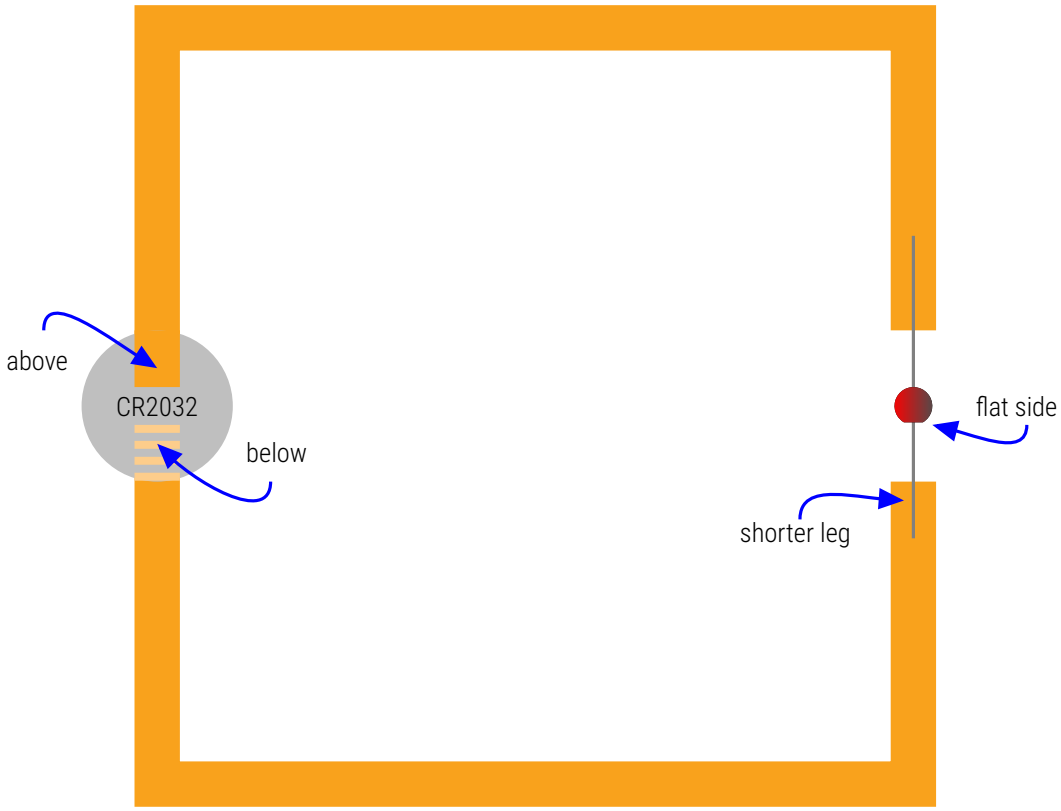
You Will Need:

- (1) CR2032 Coin Battery
- (1) LED
- (1) Roll of Copper Tape
- (1) Roll of Cellophane Tape

Directions:

Create the paper circuit below by tracing the lines with copper tape and placing the components where indicated.

Note: For a coin battery, the positive and negative terminals are the top and bottom of the battery. This requires the battery to be "sandwiched" between the copper tape as indicated in the diagram below.



Circuit #2

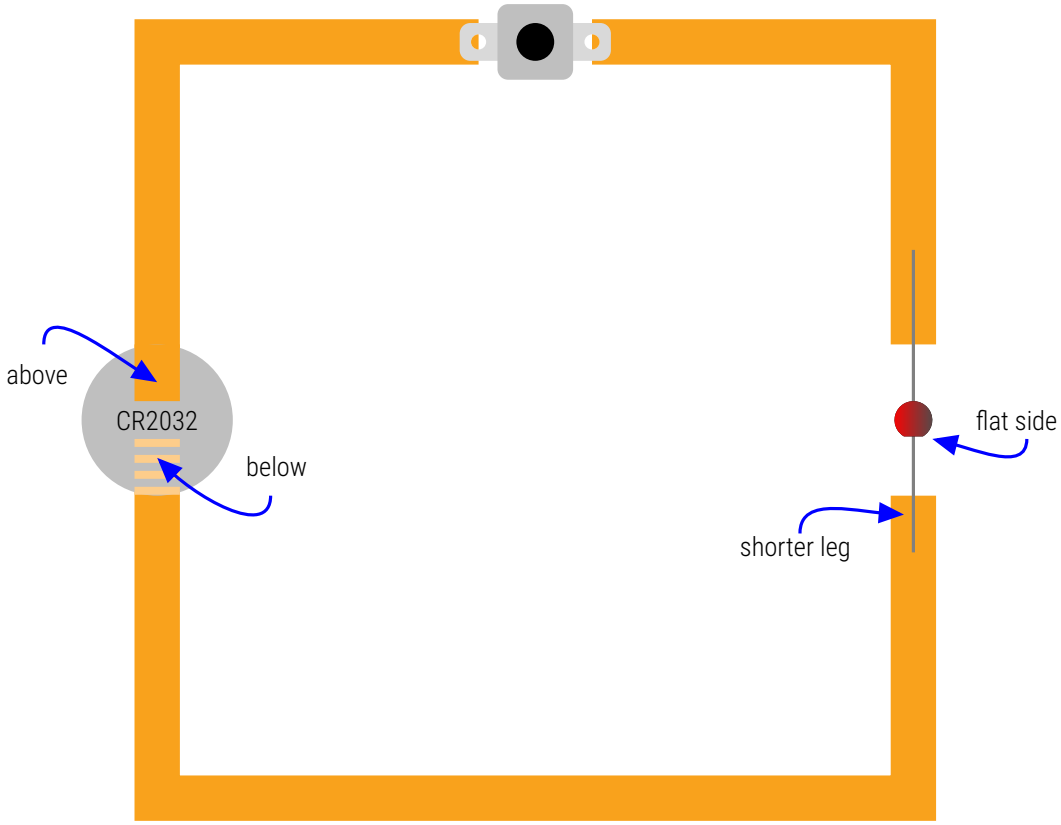
This second circuit introduces some control over the flow of electricity by adding a push button.

You Will Need:

- (1) CR2032 Coin Battery
- (1) LED
- (1) Push Button
- (1) Roll of Copper Tape

Directions

Create the following paper circuit. Your push button may look slightly different from the one in the diagram, so make the appropriate adjustments.



FORMATIVE ASSESSMENT	
Q4 In the spaces below, sketch the circuit diagrams for each of the two paper circuits you build.	
Circuit #1	**Circuit #2**

FORMATIVE ASSESSMENT

Q5 In the space below, sketch a paper circuit that will include (2) LEDs.

Q6 Predict what will happen when your circuit is powered. Then, test your hypothesis by building the paper circuit.

Q7 What actually happens when your circuit is powered? Why do you think this behaviour occurs?

Reflections

ATL SKILL (Communication Skills)

...make inferences and draw conclusions...

Q8 Why do you think the ability to draw conclusions from incomplete information or knowledge is an important skill to develop? Are there any dangers in doing so?

...use and interpret a range of discipline-specific terms and symbols...

Q9 In what other contexts are special terms and symbols used? Consider examples from your daily life, such as your hobbies and other activities, and not just academics.

Q10 What aspect of this lesson was the most challenging for you? How did you overcome that challenge?

Q11 Select the option which best reflects how confident you are in applying what you have learend in this lesson.



Q12 What additional questions do you still have about this lesson's content?