# Electricity Basics

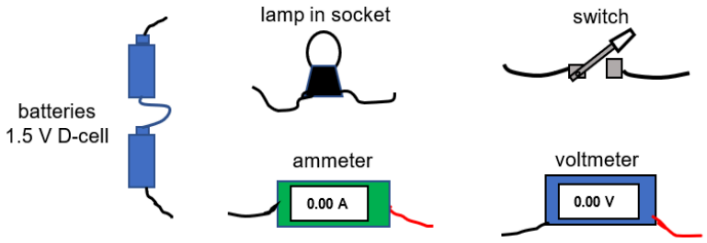
## Introduction

We use **electricity** every day, almost every minute. Furthermore, electrical devices use energy. They get the energy from the current that flows through them. When designing an electrical device, or an **electric circuit**, it is important for the proper amount of current to flow for the voltage that will be applied. In this lab, you will build circuits and learn about **voltage** (volts) and **current** (amps) which are fundamental quantities that describe the electricity we use. You will then investigate **resistance**, which is the property that relates current and voltage in a circuit or electrical device.

**Objectives:** After today, you should be able to: get a light bulb to light up on your own, draw a picture of what a light bulb looks like on the inside, define and give examples of conductors and insulators.

**You may be provided with a power source in place of batteries- your teacher will give you instructions.**
**NOTE: NEVER HOOK A BATTERY UP TO ITSELF!!!!!**

Diagram key:




## Part 1
## making a bulb light

**Challenge 1:**
Using only one bulb, wires,
a switch and one battery,
can you light it up with only one connection to the lamp?
*a)Draw a picture of your setup below*

b) How can you tell if an electric current is flowing in the circuit?

c) Can you see the current flow?

Current is defined as the “imaginary flow of positive charge” – in this case – from the positive end of the battery to the negative end. However, as most people know, it is actually electrons that flow from the negative end to the positive end. It is very difficult to prove that it actually is electrons that flow

d) If the current flows from positive to negative, draw arrows in your picture above to represent the current flow through your circuit.

e) Why might the word “closed” be the best choice to describe your set up?

2. Turn the switch to off- the bulb does not light.

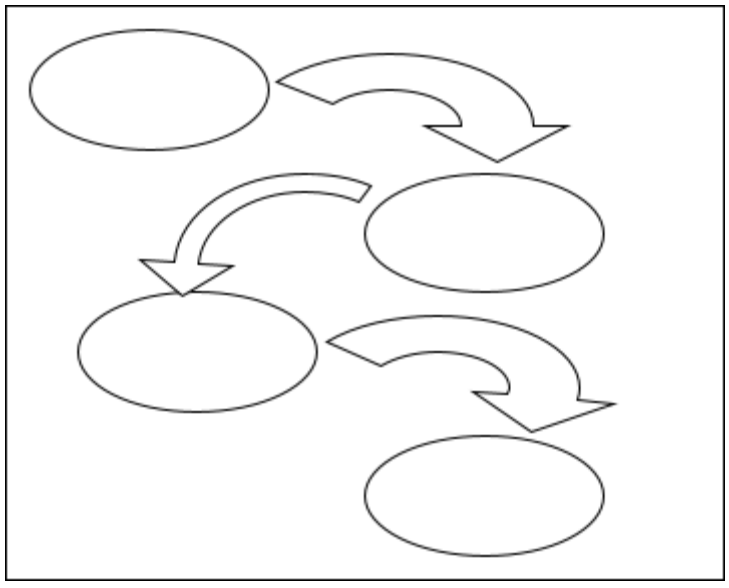
a) How does the switch affect the current’s flow?

*For describing electric circuits we use the language of circuit diagrams. In a circuit diagram, wires are represented by solid lines. Electrical devices like batteries, switches, and bulbs are represented by symbols.*

→ Using the appropriate symbols, draw a diagram of the circuit you just built (minus the circuit board).


## Time for a class discussion!

### ENERGY FLOW DIAGRAM



## Part 2: Conductors & Insulators

Materials in which electric current flows easily are called ***conductors*** and materials that current does not flow through easily are called ***insulators***.

1. Break one connection in your one-bulb circuit by moving wires to different metal posts, leaving an "open circuit" (see picture below).
2. Complete the circuit by touching different materials (in the data table) between the clips such that you are creating a closed circuit. Record your observations as to which materials allow the bulb to light and which do not. Also, put a checkmark next to the material(s) that allow the bulb to light the brightest. Put a "0" next to the material(s) that barely made the bulb light up.

| Material | Conductor or Insulator? | Material | Conductor or Insulator? |
|---|---|---|---|
| sponge | | plastic straw | |
| paperclip | | Copper penny | |
| Steel wool | | rubber band | |
| Wood piece | | marker | |

b) What characteristics are shared by the conductors you found?

c) What characteristics are shared by the insulators you found?


**Let's chat before we move on…**

## Part 3 Measuring the Voltage of a Battery

(for this part- set aside the battery eliminator and use the two D-Cell batteries located in the box- they should both be in white holders)
Notes on how to use a multimeter: Using the voltmeter, touch the two leads/ends of the alligator clips to the ends of the battery. **Do not break the circuit, just place a lead on each side of the battery to get a reading**

1. A. What is the voltage reading on the actual battery? _____

   B. What is the voltage reading on the voltmeter? _____

   C. Why might the numbers from **a** and **b** be slightly different?

2. Take a second battery and connect it to the first by touching the ends together. Measure and record the voltage for the 4 possible ways to connect the two batteries. (pay attention to the upper right you will notice a V- volts or mV for millivolts. If you see the mV you divide (move the decimal 3 places to the left) by 1000 to get your answer in volts)

a) + to + _____ b) + to - _____
c) - to + _____ d) - to - _____

3. How do the readings for **b** and **c** compare to the voltage reading for just 1 battery?

4. How can you explain the differences in voltage for **b** and **c** compared to the voltage reading for **a** and **d**?

## Part 4: Measuring current

To measure current, the meter must be connected so the current has to flow through it. **This means the Ammeter MUST be part of the circuit.** <u>This is different from voltage measurement</u>. <u>*To measure current you must force the current to flow through the meter by eliminating all other paths the current could go*</u>. ***Follow the instructions below carefully. Too much current can damage the meter.***

3. Set the ammeter to measure current by making it PART of the circuit. *(hint, the bulb should be lit if the circuit is complete* and that current is flowing through the meter*) I would suggest connecting it to the switch*

4. Record how much current is flowing in the circuit. *Watch your units!* (if you see a small m on the reading, this is because the unit is in milliamps. Simply divide by 1000 to get the current in amps.

**Current is _____**


## Let's talk…Shall We?