

## Light Bulb Experiment Kit

OHM-300

Our **Light Bulb Experiment Kit** offers teachers a remarkably easy way for students to understand the circuit concept and quickly move into dozens of simple experiments on parallel, series and combination circuits.

The key is the D Cell battery holders (and of course, the batteries themselves). The kit comes with eight of these beauties. One holder may not seem like much on its own, but once you start connecting them... you're ready to shine a light on a memorable lesson in electricity.

### A Quick Review

When we talk about electricity, we typically talk about three things: watts, volts and amps. These are universal units. Each one measures something different.

**Watts** are a basic measure of power.

**Volts** are the standard unit of electromotive force.

You can think of volts literally as a pushing force. The higher the voltage, the harder the electricity is being pushed through the circuit.

**Amps** are the equivalent of volume. When you think about how much amperage you have available, you're basically asking, *How big is your "container" full of electricity?*

Other key words you'll need to introduce to your students:

**Circuit:** Electricity flows in a loop called a **circuit** which begins and ends at the battery pack.

**Load:** Any device that consumes the energy flowing through a circuit and converts that energy into work is called a **load**. A light bulb is an example of a load; it consumes the electricity from a circuit and converts it into work (in the form of heat and light).

### Your Kit Includes:

- ✓ 4 light bulb holders with Fahnestock clips
- ✓ 4 pairs of wires with alligator clips
- ✓ 10 miniature light bulbs
- ✓ 8 D cell battery holders
- ✓ 8 D cell batteries



# Simple Circuit



**Please note:** Before you begin, point out that the inside of the battery holder is marked with a + for the positive end of the battery, and a — for the negative end of the battery. (Also point out that the battery has similar markings.)

## Directions:

1. Have your students place a single battery in one of the battery holders.

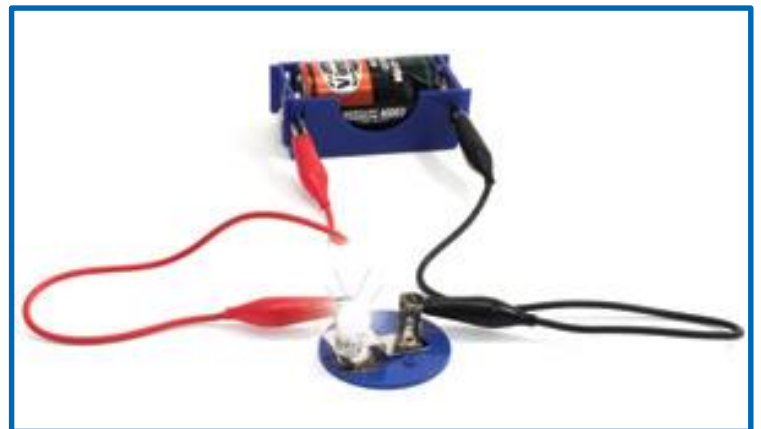
2. Next, screw one of the 3 volt light bulbs into a light bulb holder. Ensure that the bottom of the bulb touches the metal plate at the bottom. Have students predict what will happen if they connect the battery to the light bulb holder with only one wire. (*The bulb should not illuminate because there is not a complete circuit.*)



3. Have them connect one of the wires with alligator clips to the positive end of the battery holder and the other end to one of the connectors on the light bulb holder. Was their prediction correct?

4. Next, connect another wire from the negative side of the battery holder to the OTHER connector on the light bulb holder. (Traditionally, a black wire is used for negative, and red for positive.)

5. If you have good connections, your light bulb should be glowing. You now have a 1.5 volt battery providing electricity to a bulb that can handle up to 3 volts. Have your students make note of how bright the bulb is.



6. Point out that you have a complete loop with the wires, battery, and bulb... in other words, you have created a circuit. The electricity has a clear path between the positive and negative ends of the battery, passing through the wires and the bulb. This is referred to as a “**closed circuit.**” If you remove an alligator clip from any one of the connections you will create an opening and your light bulb will go out. This is an “**open circuit.**” Try creating an opening at different places in your circuit. What happens when they open the circuit? (*The light goes out.*)

# Circuit with Batteries in Series

## Directions:

These battery holders can be connected in two different ways, either side to side, or end to end.

1. Have students connect two battery holders end to end, with the negative end of one holder connecting to the positive end of another. Simply line up the holders and slide them together.



## What's Going On?

These batteries are referred to as being “in series.”

In a series circuit, voltage is added together.

In this case, 1.5 volts plus 1.5 volts is 3 volts, so your set of batteries is providing 3 volts.

2. Ask your students to predict what will happen to the brightness of the bulb when they complete the circuit.
3. Instruct them to connect the batteries to the light bulb (as they did in Lesson 1).

## Ask these questions to your students:

- ✓ How does the brightness of the bulb compare to your earlier circuit? *(Remember, these are 3 volt bulbs and your battery set is now providing 3 volts. If you add more batteries in series, you will burn out your bulbs.)*
- ✓ Try opening and closing your circuit. Is there any difference from your earlier circuit?

# Circuit with Light Bulbs in Series

## Directions:

Let's add a second light bulb to your circuit.

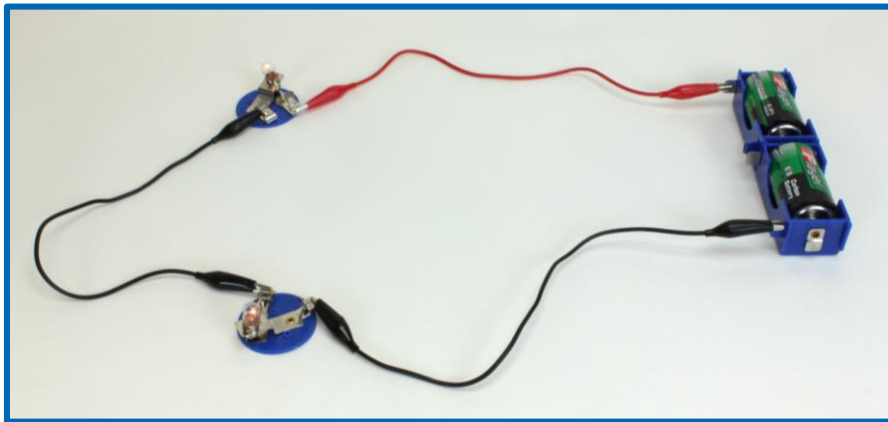
1. Have students use the wires to connect from one side of a light bulb holder to the positive side of your battery set.
2. Connect from the other side of the light bulb holder to a connector on a second light bulb holder.
3. Use one last wire to connect back to negative side of your battery set.

## What's Going On?

As mentioned earlier, in a series circuit, voltage is added together.

This is true for both voltage provided (the batteries) and voltage used (the light bulbs).

Because we have two 3 volt light bulbs in series, they can handle and would like 6 volts.



## Ask these questions to your students:

- ✓ How much voltage is your set of batteries providing? (*3 volts*)
- ✓ How is this affecting the brightness of the bulbs? (*They are dimmer than with a single bulb.*)
- ✓ Try creating an open circuit in different places in your circuit. What happens if you unscrew one of your bulbs? (*The light bulbs go out.*)

# Circuit with Batteries in Parallel

## Directions:

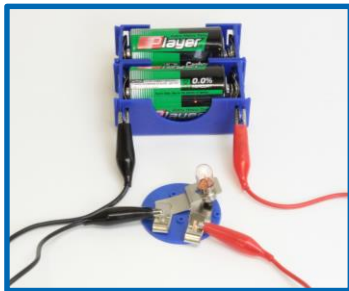
Up until now, we have been dealing with series circuits. Series circuits are much like a loop or a circle. If the circle is broken, the lights do not work. Now we are going to work with parallel circuits, which are similar to the steps on a ladder.

1. Connect two of the battery holders in the side by side position. Each battery holder has two tabs on one side, and two slots on the other.

2. Insert the tabs of one into the slots of the other so that positive is connected to positive, and negative is connected to negative. We now have two batteries connected in parallel.



3. Have students connect their parallel two battery set to one of the light bulbs.



4. Compare the brightness to the earlier set of two batteries in series. Add one or two more batteries in parallel.

## Ask these questions to your students:

- ✓ How does adding more batteries in parallel change the brightness of the bulb? (*It has no effect.*)

## What's Going On?

Unlike our earlier series example, we do not add the voltage for parallel circuits. The voltage remains 1.5 volts, the same as a single battery. The same would be true if we connected three batteries this way, or ten, or eighty three. We would always have the same 1.5 volts available.

Instead we add **amperage**.

Increased amperage would allow us to power high-amperage devices such as certain electric motors. In the case of our light bulb kit, higher available amperage would allow us to light our bulbs for a longer amount of time.

If one battery would light our bulb for about five hours, two batteries in parallel would light our bulb for about ten hours.

# Circuit with Light Bulbs in Parallel

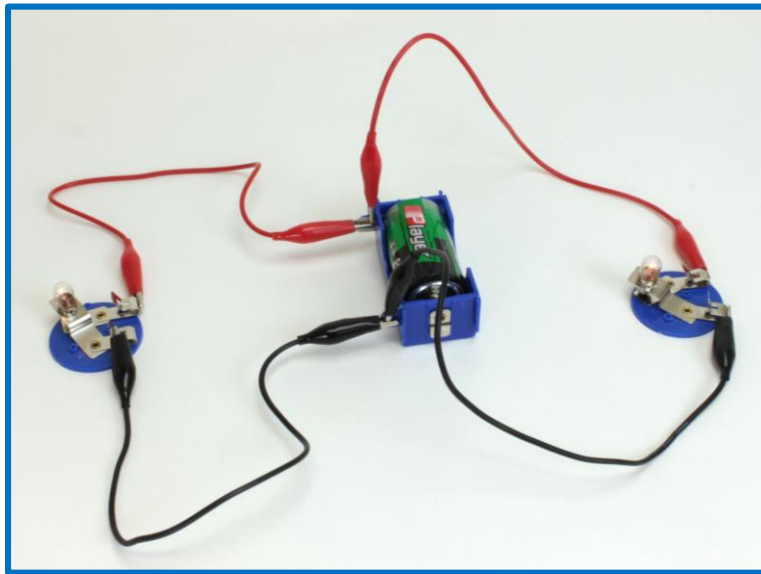
## Directions:

1. Have students prepare two light bulb holders with wires, so that each bulb holder has a wire on each connector ready to connect to a battery.
2. Get a single battery holder with a battery in it.
3. Connect the wires of one of the light bulb holders to the tabs on the battery holder (as in Lesson 1). As always, take note of the brightness of the bulb.
4. Without disconnecting anything, add the other light bulb holder, connecting the wires of this one to the same tabs as the first one, so they are sharing the same battery.

## What's Going On?

With a parallel circuit, voltage is not added—amperage is. And this is true for both amperage provided (the batteries) and amperage used (the light bulbs).

So if one battery would light one bulb for about five hours, one battery would light two bulbs in parallel for about two and a half hours.



## Ask these questions to your students:

- ✓ Did your bulbs change in brightness?
- ✓ Try opening the circuit by disconnecting one of the wires. Did both bulbs go out?

## Ideas for Additional Experiments

Can you create a circuit that is a combination of series and parallel, perhaps batteries in parallel and bulbs in series?

Can you create a circuit that has some bulbs in series and some in parallel?

### Follow-up questions:

For a typical flashlight that uses two or more batteries, are they connected in series or parallel?  
*(Series)*

When you see Christmas lights, would it be better to wire the lights in series or parallel? Why?  
*(Parallel, because if you wire them in series, when one light goes out, they would all go out.)*

## Take Your Lesson Further

As science teachers ourselves, we know how much effort goes into preparing lessons. For us, “*Teachers Serving Teachers*” isn’t just a slogan—it’s our promise to you!

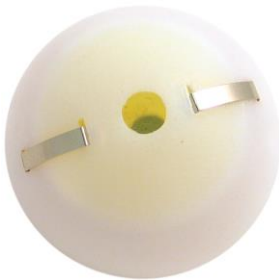
Please visit our website  
for more lesson ideas:

[www.TeacherSource.com](http://www.TeacherSource.com)

Check our blog for classroom-tested  
teaching plans on dozens of topics:

<http://blog.TeacherSource.com>

To extend your lesson, consider these Educational Innovations products:



### **Energy Ball** (SS-30)

The Energy Ball is all you need to safely introduce your students to electric energy. A fun way to demonstrate open and closed series circuits without any danger of electric shocks! When the 1.5 inch ball is turned on, a red light flashes and a buzzer buzzes. Turning the ball on is the fun part—just touch the metal strips with your two index fingers. Your body forms the conducting material that bridges the gap between the two metal strips and closes the circuit!

### **Electronic Snap Circuits** (OHM-125)

Snap together electronic blocks to build over 300 different electronic circuits. All of the components (diodes, capacitors, resistors, transistors, etc.) are mounted with snaps that can be easily connected and disconnected. No soldering or wire twisting required. Learn by snapping together components to build a radio, light bulb circuits, doorbell, siren, water detector or electronic fan.

