

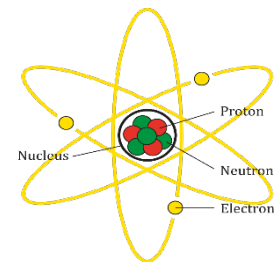
What's it all About?

With this project sheet, you will be making and exhibiting a circuit board. This board will help you understand how simple electrical circuits work. Electricity makes our life easier. It helps play our music, gives us light, heat and cools our house, and cooks our food all done with electrical circuits. Electricity is a form energy used to produce motion, light, and heat. What makes this energy? The energy is formed by tiny particles called electrons (see image). These electrons are so small they cannot be seen with an ordinary microscope. These electrons flow much like water flows in a garden hose. The flow of these electrons creates energy and the energy made by this movement is called electricity. When flowing they make electric current and do work. With your completed and closed-circuit electric current will flow and do work/make light.

Materials Needed

- 1 board no larger than 6"x6"
 - 2 – C batteries
 - A battery clip with soldering terminals
 - 2 – single strand insulated wire, each 12" long – one black and one white
 - 1 SPST knife blade switch
 - 8 small screws (not included with kit)
 - 2 miniature light sockets with solder terminals
 - 2 – 1 ½ volt flashlight bulbs or LEDs
 - Electric solder (resin core)
- (Obtain an Electric Circuit kit from your local Extension Office)

SIMPLE ATOM



Tools Needed

- Ruler
- Pencil
- Hammer
- Soldering Iron
- Wire Strippers/cutters
- Screwdriver
- Needle nose Pliers

For the Project

- Record sheet

- 4-H Exhibit Skills and Knowledge Sheet
- Circuit Board labeled as either Series or Parallel Circuit

Making the Board

- Sand and paint, varnish, or stain your board.
- Lay out the board with a pencil and ruler as indicated in Figure 1 or get creative without changing the wiring.
- Attach the lamp sockets, battery clip, and the single pole switch to the board with small screws. (With some switches, it is easier to attach the black wires to the screw terminals before mounting.)
- Read through the instructions for making both the parallel circuit and series circuit BEFORE you begin, to decide which one you will make.

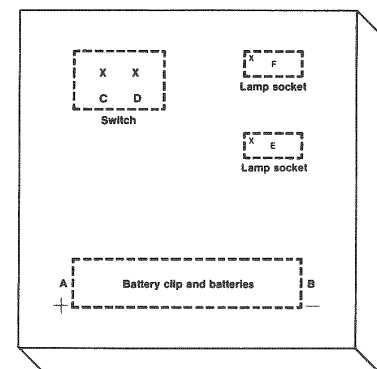


Figure 1. Circuit Board Diagram

How to Solder

To make good, lasting connections to the battery clip and permanent connections in the circuit for your exhibit, you will need to solder the connections. To solder the connections, follow these three steps:

- Be sure all metal-to-metal connections are clean and tight
- Heat the connection by touching the hot solder iron to it and touch the solder to the connections. (be sure to use resin core solder only)
- Let the connections melt the solder. Only a small amount of solder is necessary. A good solder will have a smooth shiny surface.

Parallel Circuit

- Lay out the circuit path (Figure 2). Use the black wire for the positive side of the circuit (+ end of the battery). With the wire strippers/cutters, carefully remove about ½ inch of insulation from each of the wires.
- Attach a black wire to the positive (+) terminal (A) of the battery clip and run this under the screw on the open side (C) of the knife switch. Always wrap wire clockwise around screws. Tighten the screw.
- Attach one black wire under the screw on the knife blade end (D) of the switch, and run to the back terminals (G & I) of the lamp sockets (E) & (F)
- Attach a white wire the front terminal (J) of lamp socket (F) and run it to the front terminal (H) of lamp socket (E). Attach a second white wire to front terminal (H) of lamp socket (E) to the negative (-) terminal of the battery clip (B).
- Close the switch. Both bulbs will light. If they don't check the connections; make sure the contacts and wire are clean and free from corrosion.
- After checking to see if both bulbs light up, solder or firmly attach the wires to the terminals

Now you have a parallel circuit – a closed circuit in which electricity runs all the way from the positive pole of the battery clip to the negative pole. The black wire is the “hot side”, because it carries the full battery voltage. Remember, battery current is direct current (DC).

Completed Parallel Circuit

Trace the circuit pictured in Figure 2. Electricity is flowing to each bulb equally. This amount is the same that would go to a single bulb circuit. The only difference between a two-bulb circuit and a one-bulb circuit is that in the two-bulb circuit, the battery will only last half as long as in the one-bulb circuit.

It is like a pail of water with two open spigots – the pail empties twice as fast as it would with just one spigot open. This circuit is only completed when the switch is closed, which is similar to the pail’s spigot being open. In a completed parallel circuit, each bulb is wired separately and equally. If one bulb is unscrewed, the other will stay lit. Try it and see.

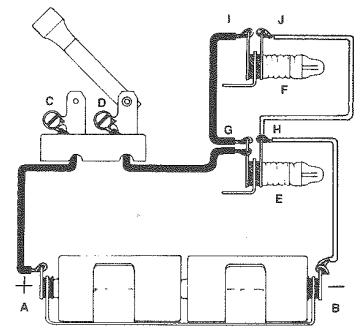


Figure 2. Completed parallel circuit

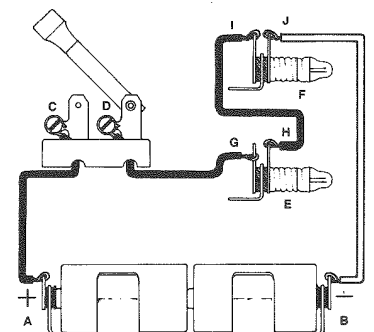
Series Circuit

- Lay out the circuit path (Figure 3). Use the black wire for the positive side of the circuit (+ end of the battery). With the wire strippers/cutters, carefully remove about ½ inch of insulation from each of the wires.
- Attach a black wire to the positive (+) terminal (A) of the battery clip and run this under the screw on the open side (C) of the knife switch. Always wrap wire clockwise around screws. Tighten the screw.
- Attach a black wire under the screw on the knife blade end of the switch (D) and run it to the back terminal (G) of lamp socket (E).
- Attach a black wire to the front terminal (H) of lamp socket (E) and run to the back terminal (I) of lamp socket (F).
- Attach a white wire to the front terminal (J) of lamp socket (F) and run to the negative (-) end of the battery clip (B).
- After checking to see if both bulbs light up, solder or firmly attach the wire to the terminals.

In the series circuit, there is just one continuous circuit. If one bulb is unscrewed the other will not light because the circuit is broken for both. Anything that breaks the circuit has the same effect as opening the switch.

Completed Series Circuit

Show that this is a series circuit through the bulb by screwing and unscrewing the bulb (F). Leave the bulb (F) unscrewed. Bypass the bulb by touching one end of a wire to terminal (I) and one end to terminal (J). The bulb at (E) will light up. Trace this new circuit.



Be sure to label the project as “series” or “parallel circuit”.