

Burglar Alarms Game Plan

eCamp Electric Lab

Objective You're going to be taking your electrical circuitry one step further by adding in sneaky switches that will activate your buzzers and lights when you want to. By studying conductivity and the different types of switches, we'll learn how to accurately control when things turn on and off. These burglar alarms lay the foundation for building sensors for robots, which is in our next set of experiments.

Main Ideas While the kids are playing with the experiments see if you can get them to notice these important ideas. When they can explain these concepts back to you (in their own words or with demonstrations), you'll know that they've mastered the lesson.

1. Electrons cannot be seen, but they are very small particles that are easy to move around.
2. Parallel connections are plus to plus, series connections are plus to minus.
3. Switches interrupt the flow of electricity. They can either make the electricity flow or not, depending on the type of switch.

About the Experiments The experiments in this section are divided into two levels: the K-4 level are mostly the same ones found in Unit 10. The 5-8th level are primarily for students wanting to get started in electronics. Don't feel limited by our recommendations, though – if you feel you want to try either level, go for it!

Electricity experiments can be frustrating because unlike other activities, you can't tell where you're going wrong if the circuit doesn't work. Here are the things we test for when troubleshooting a circuit with the students:

1. Are the batteries in right? (Flat side goes to the spring.)
2. Is the connection between the alligator clip and the wire a metal-to-metal connection? (Often kids will clip the alligator clip onto the plastic insulation.)
3. If it's an LED that you're trying to light up, remember that those are picky about which way you hook up the plus and minus (red and black). Switch the wires if you're having trouble.
4. Change out the wires. Sometimes the wire can break inside – it can get disconnected from the alligator clip inside the plastic insulation, but you can't see it. When in doubt, swap out your wires.

The How and Why Explanation The movement of electric charge is called electric current, and is measured in amperes (*A*, or *amps*). When electric current passes through a material, it does so by electrical conduction, but there are different *kinds* of conduction, such as metallic

conduction (where electrons flow through a conductor, like metal) and electrolysis (where charged atoms (called ions) flow through liquids).

Why does metal conduct electricity? Metals are conductors not because electricity passes *through* them, but because they contain electrons that can move. Think of the metal wire like a hose full of water. The water can move through the hose. An insulator would be like a hose full of cement - no charge can move through it. For example, paper doesn't conduct electricity (it's an insulator). Soda cans are both – the painted part of a soda can is an insulator, but the metal part is a conductor.

Burglar alarms not only protect your stuff, they put the intruder into a panic while they attempt to disarm the triggered noisemaker. Our burglar alarms are basically switches which utilize the circuitry from Basic Circuits and clever tricks in conductivity.

Questions to Ask When you've worked through most of the experiments ask your kids these questions and see how they do:

1. Where can you find a NC switch? NO switch?
2. What types of materials conduct electricity?
3. How can you use a switch as a sensor for a robot?
4. Can you think of a switch that turns electricity OFF when you push it?