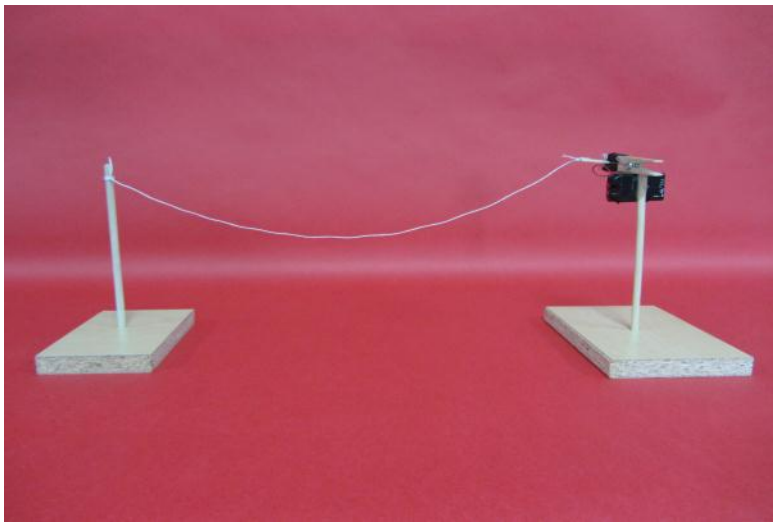
Trip Wire

Category: Physics: Electricity & Magnetism

Type: Make & Take



Rough Parts List:

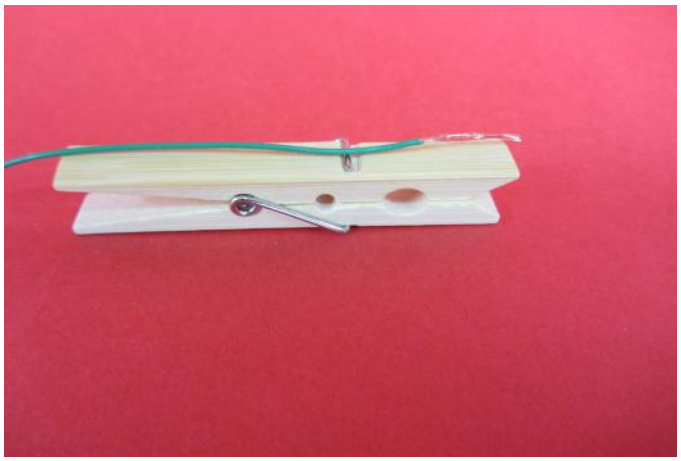
1	Clothespin
1	Buzzer
1	Battery
1	Small piece of foil
6”	Electrical wire
18+”	Fishing line
1	Popsicle stick
2	Dowels
2	Blocks of wood

Tools List:

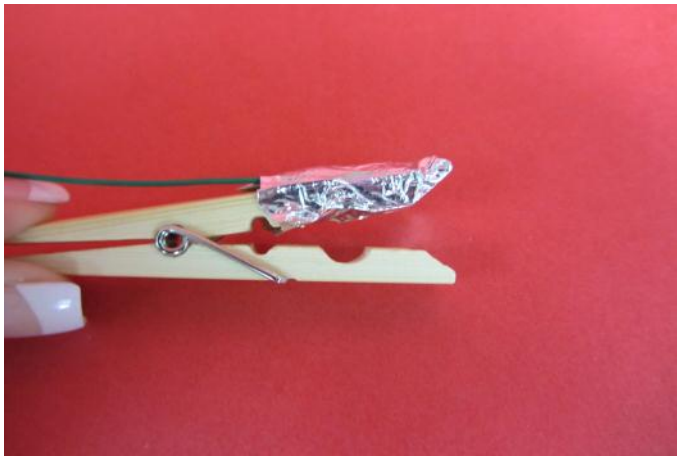
Scissors
Electrical tape
Hot glue gun
Wire strippers

Video: http://www.youtube.com/user/FresnoCSW/videos

How To:



Strip both ends of electrical wire.
Place it on top of the clothespin.



Wrap a small piece of foil around
one tip of the clothespin and wire.

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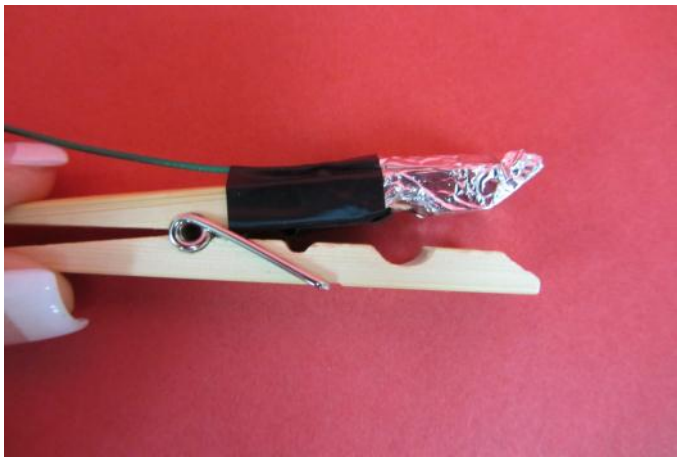
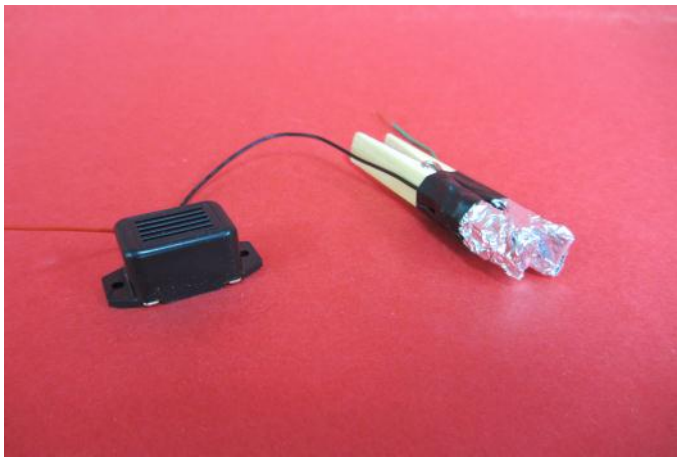
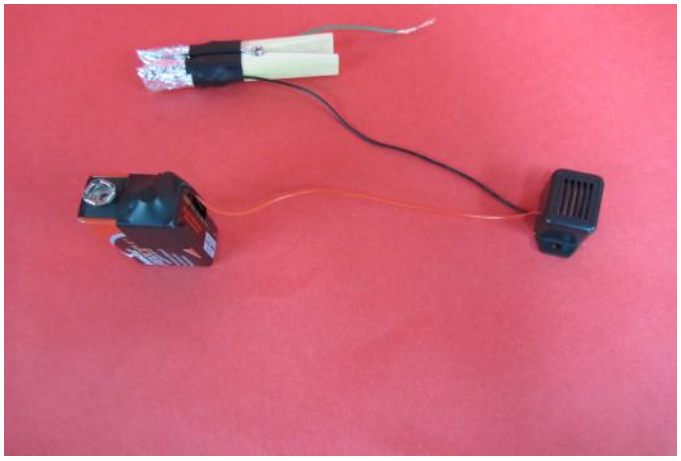


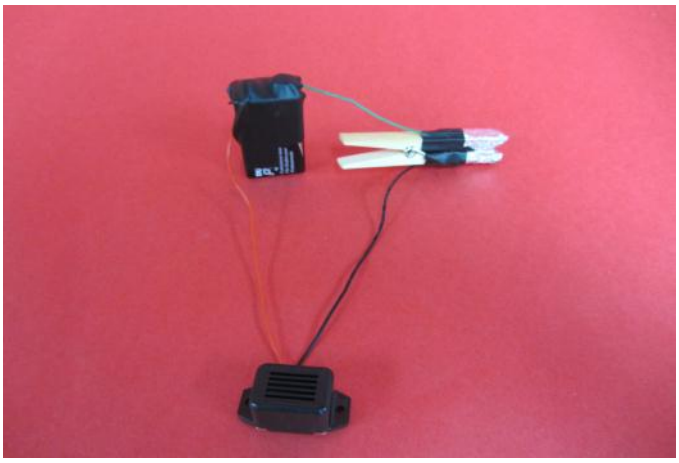
Wrap a small piece of electrical tape around the foil to ensure it will not come loose.



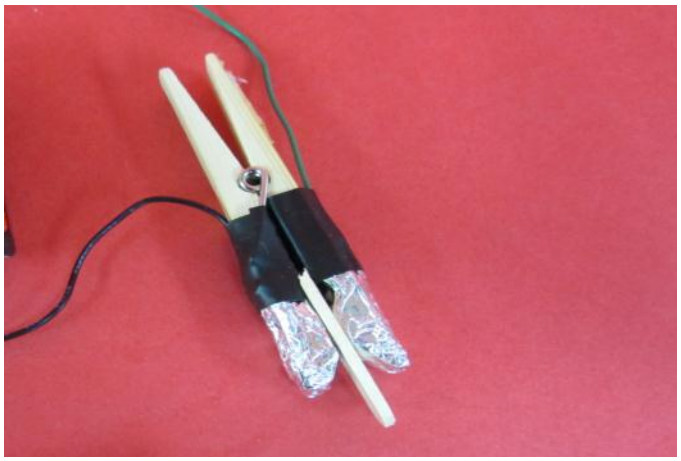
In the same manner, attach the negative wire from the buzzer to the free clothespin tip using foil and electrical tape.



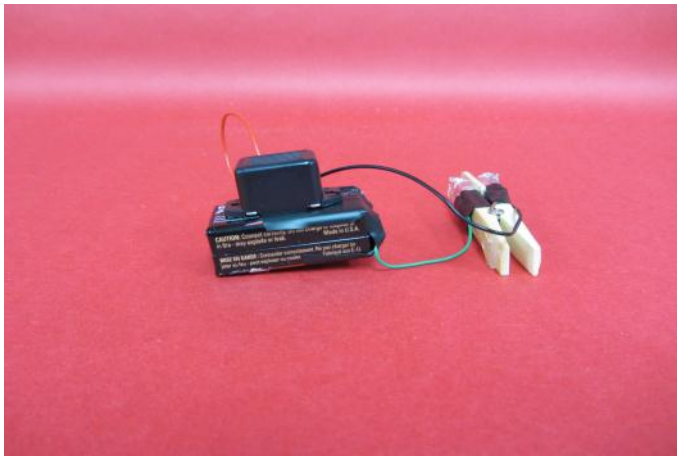
Attatch the positive wire to the positive end of the battery with electrical tape.



Complete the circuit by connecting the electrical wire from the clothespin to the battery. If the buzzer is working the circuit is complete.



Place a popsicle stick between the ends of the clothespin so the buzzer is not constantly running.



Glue the buzzer to the battery.

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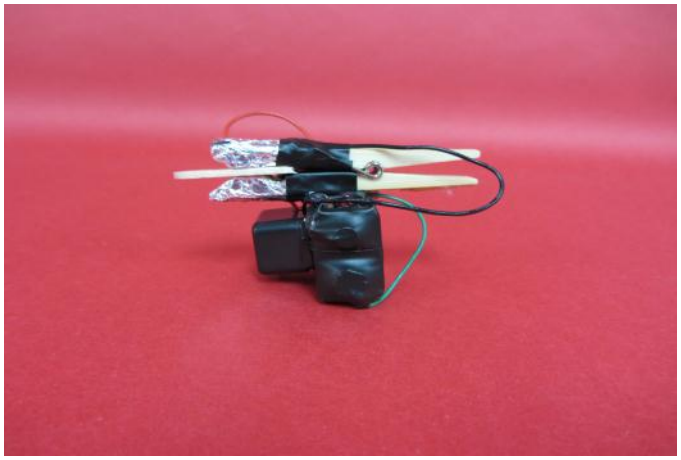
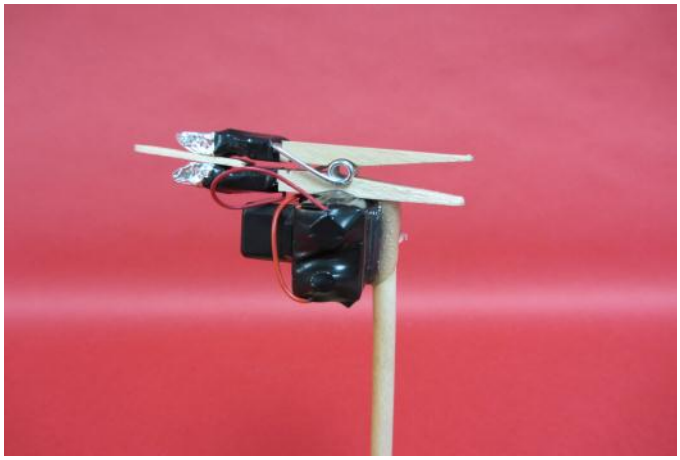


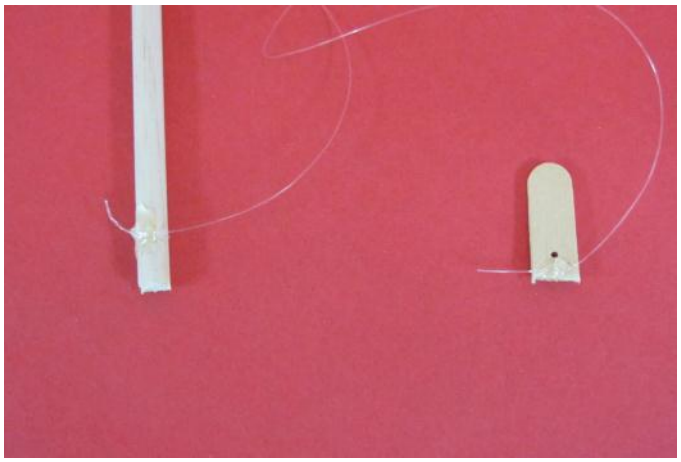
Glue the clothespin to the battery.



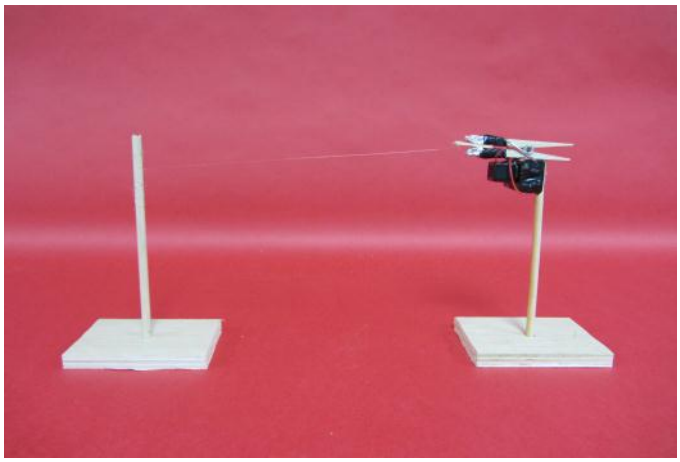
Glue the battery to a dowel.

Drill one hole in each of the wood blocks.

Push the dowel with the circuit into one block.



Tie fishing line between the top of the second dowel and the popsicle stick. Use a length that will work for the place you want to install the trip wire.



Push the second dowel into a wood block and return the popsicle stick between the clothespin tips. Stretch the fishing line across the area that is going to be monitored and weigh down the blocks. When a person crosses the fishing line, the popsicle stick will pop out and set off the buzzer!

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Fine Points:

→ Buzzers are polarity dependent. If the buzzer is not working try switching the wires. The positive wire should connect to the positive battery terminal.
→ If the buzzer continuously buzzes, check to see if the foil ends are touching.
→ Fishing line works well because it is both sturdy and difficult to see.
→ To set up the trip wire in special spaces, the buzzer/switch system can be attached to anything, and the other end of the string tied anywhere.

Concepts Involved:

- Electrical energy is stored in a battery.
- Electricity has to have a complete path in order to travel from one side of a battery to the other. This path is called a circuit.
- The flow of electricity in a circuit is called **current**. A broken or "open" circuit stops the current.

Focus Questions:

1. What would happen if the popsicle stick were left out of the circuit?
2. What material other than a clothespin can be used as a switch?
3. What other materials could be used instead of the popsicle stick?
4. Is it possible to incorporate a light into the circuit?

Elaboration:

This trip wire is a simple version of a circuit. It easily demonstrates an open and closed circuit. Instead of using a switch to turn something on and off, the trip wire uses a pin to prevent the flow of electricity from traveling through the circuit. When the pin is in place it creates an open circuit and prevents the buzzer from buzzing. When the trip wire is pulled and the pin is removed, the foiled ends of the clothespin contact each other creating a closed circuit. Current flows through the circuit and the buzzer buzzes.

Real security systems use this same principle, though often with a few other elements. For example, window security devices often have a magnet that is very near an electromagnet when the window is closed. When it is open, the electromagnet senses the magnet has moved away and the circuit current changes. This triggers the alarm. Likewise laser and infrared security systems set up a circuit with a certain current. When the laser or beam of infrared light is interrupted, the current changes and this triggers the alarm.

Links to k-12 CA Content Standards:

Grades k-8 Standard Set Investigation and Experimentation:
Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other strands, students should develop their own questions and perform investigations.

Grades k-12 Mathematical Reasoning:
1.0 Students make decisions about how to approach problems:
1.1 Analyze problems by identifying relationships, distinguishing relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.
1.2 Determine when and how to break a problem into simpler parts.

2.0 Students use strategies, skills, and concepts in finding solutions:

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1.1 Use estimation to verify the reasonableness of calculated results.
1.2 2.2 Apply strategies and results from simpler problems to more complex problems.
1.3 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and models, to explain mathematical reasoning.
2.5 Indicate the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

3.0 Students move beyond a particular problem by generalizing to other situations:
3.1 Evaluate the reasonableness of the solution in the context of the original situation.
3.2 Note the method of deriving the solution and demonstrate a conceptual understanding of the derivation by solving similar problems.
3.3 Develop generalizations of the results obtained and apply them in other circumstances.

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