

BSA Electricity Merit Badge

**Electricity Merit Badge**

**Basic Electricity**

# BSA Electricity Merit Badge

## What is Electricity

Electricity results from the existence of positive and negative charges and the interaction of these charges.

All matter (material) is made up of hundreds of basic building blocks called elements.

These elements are themselves made of tiny particles called atoms.

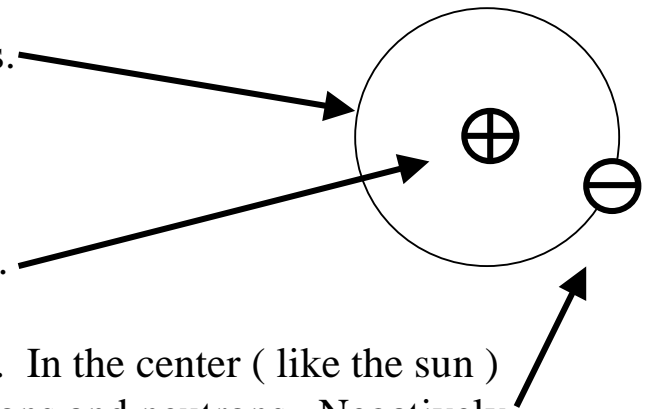
Atoms contain protons and neutrons

Protons are positive (plus +) charged and neutrons have no charge.

The atom can be compared to the arrangement of the solar system. In the center ( like the sun ) is the nucleus of the atom, which has a cluster of one or more protons and neutrons. Negatively charged particles called electrons surround the nucleus like planets orbiting the sun. The positive (or plus) charge protons equals the total negative charges of the electron.

For various reasons, an atom may lose one or more of its electrons. This leaves the atom positively charged, and out of balance. The atom may also borrow a few nearby electrons and become negatively charged. Electrons are easily lifted or rubbed off from an atom.

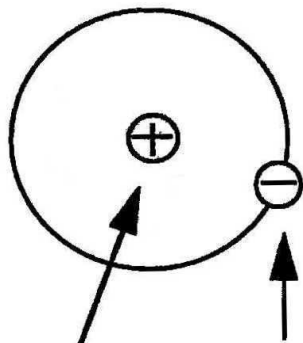
The electrical charge of the electron is the basic unit of electricity.



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## Electrical Charges of Matter

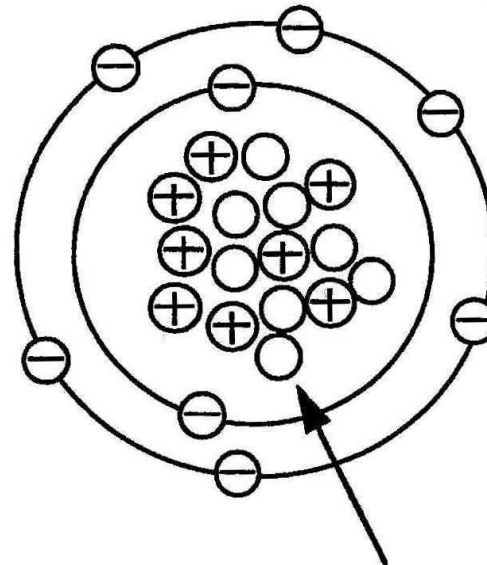
Hydrogen Atom



**electrons are  
negative (minus -)**

**protons are positive (plus +)**

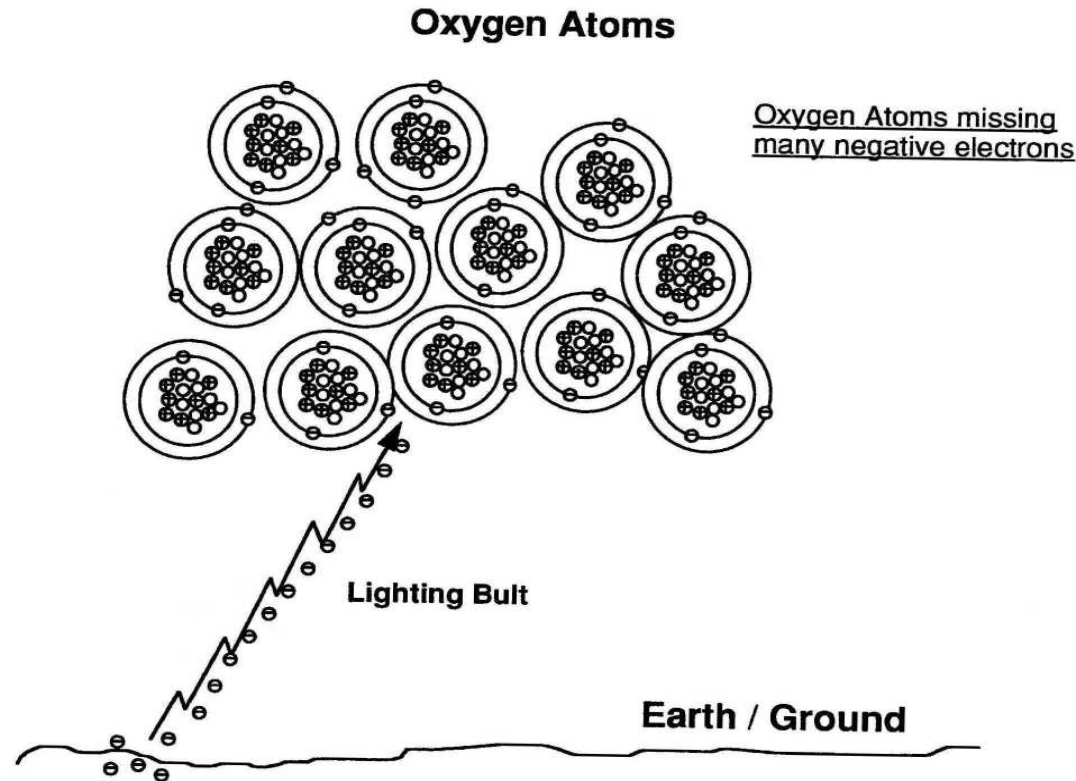
Oxygen Atom



**neutrons have  
no charge.**

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## Why Lighting Happens

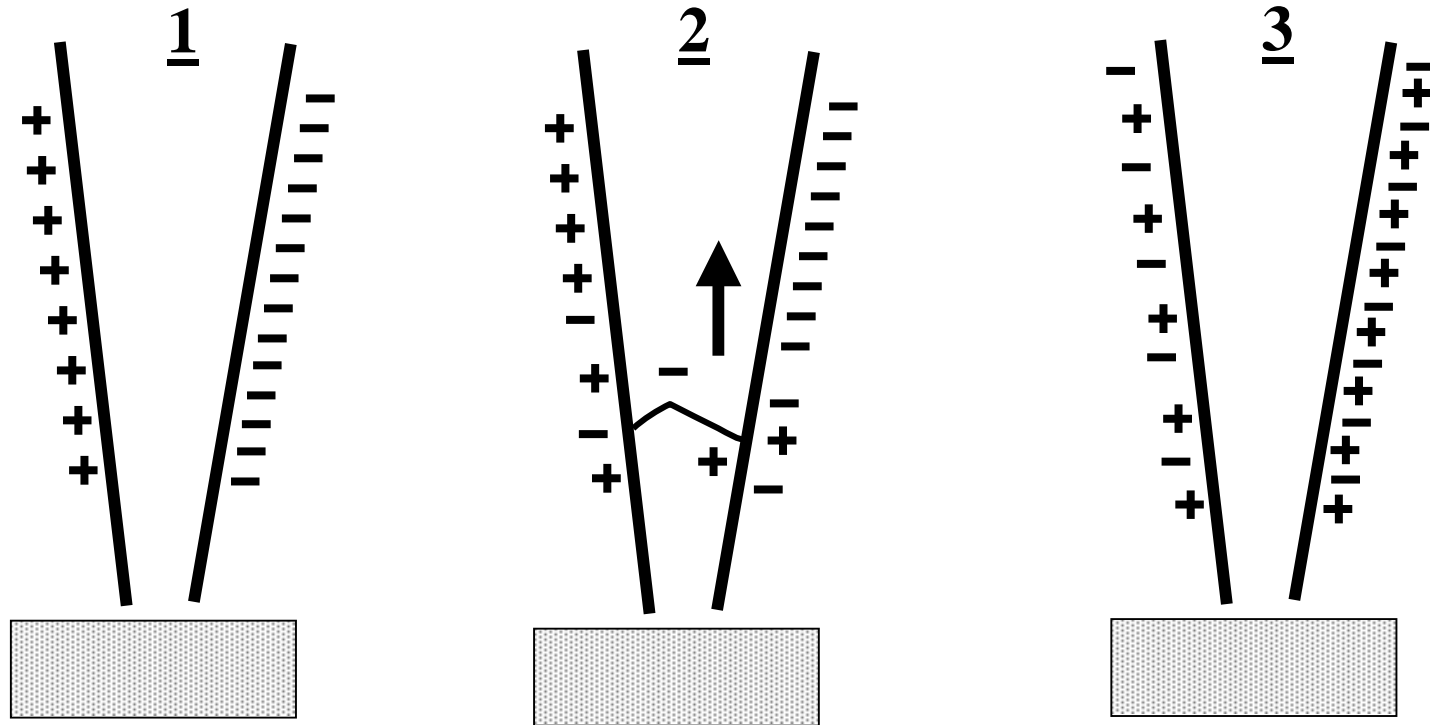


These Oxygen atoms are imbalance, because as air is moving the negative electrons get rubbed off. When enough of an imbalance is created, a surge of negative electrons will jump from the earth, creating a lighting bolt This balances off the electrons and protons.

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## Jacobs Latter

### Lighting Simulation



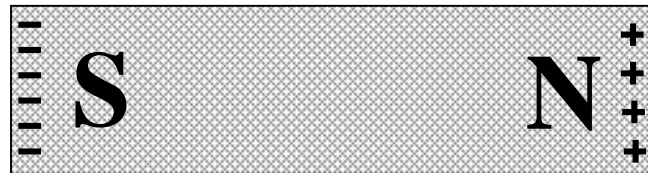
**20 KV Transformer; 120 Volts in 20,000 Volts out.**

In this example the lighting is happening thousands of times per second. The sequence is:

- 1) High voltage is applied with Positive on one side and negative on the other.
- 2) When the voltage gets high enough, the negative electrons jumps to the positive side all the way up.
- 3) The poles then become neutralized or balanced. The process starts all over again after the transformer charges the poles up again.

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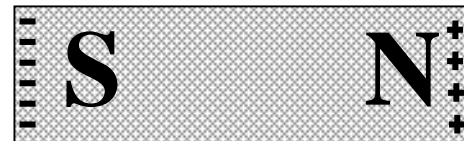
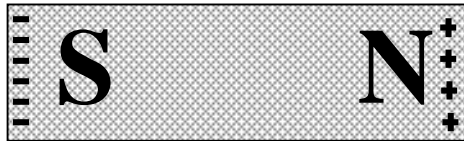
## Magnetic Field



**Draw the magnetic field around the magnet.**

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## Magnetic Field

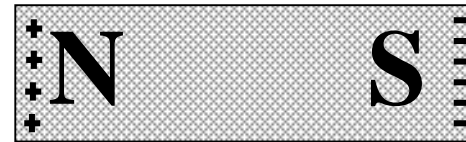
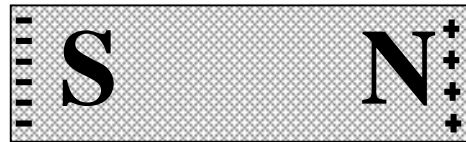


**Draw the magnetic poles around these two magnets.**

**Do these magnets attract or repel \_\_\_\_\_**

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## Magnetic Field



**Draw the magnetic field around these two magnets.**

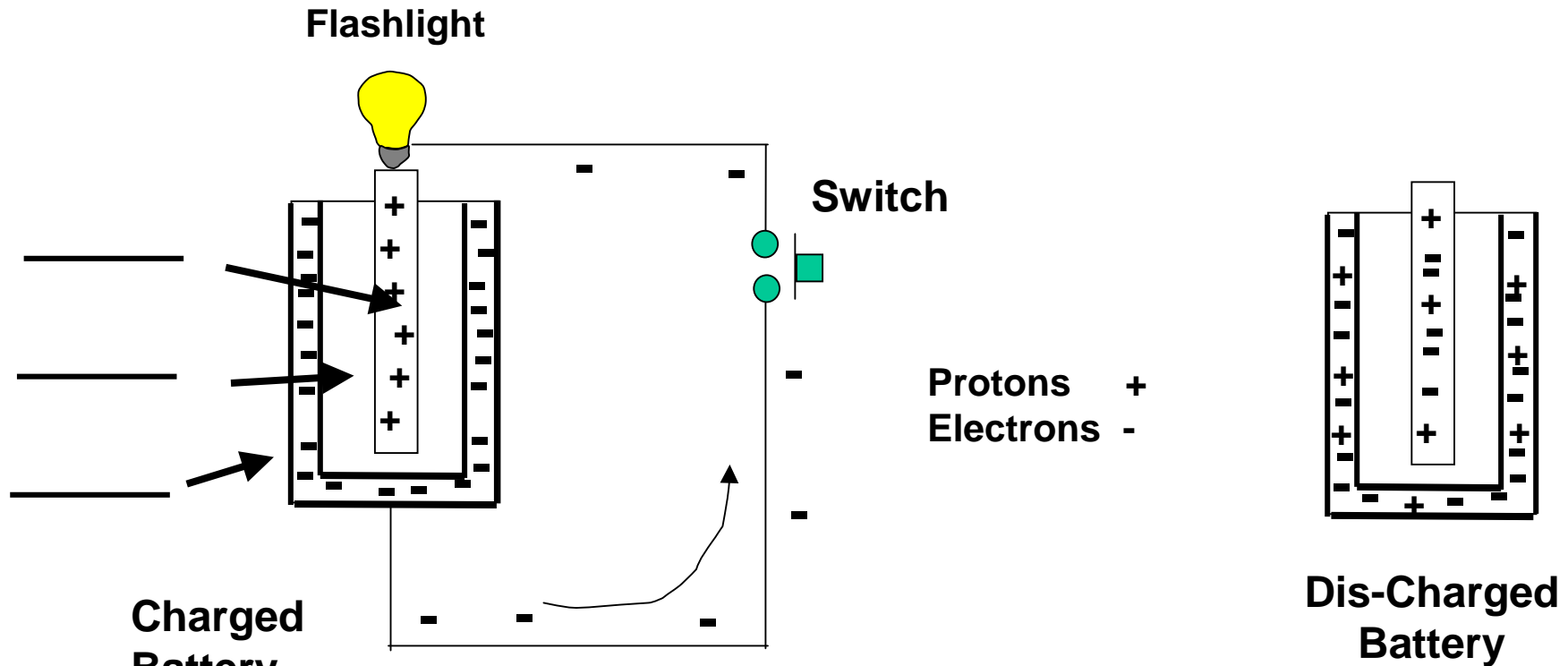
**Do these magnets attract or repel \_\_\_\_\_**

**Distribute the magnets and plates and try to duplicate these magnetic fields.**



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**DC=Direct Current**



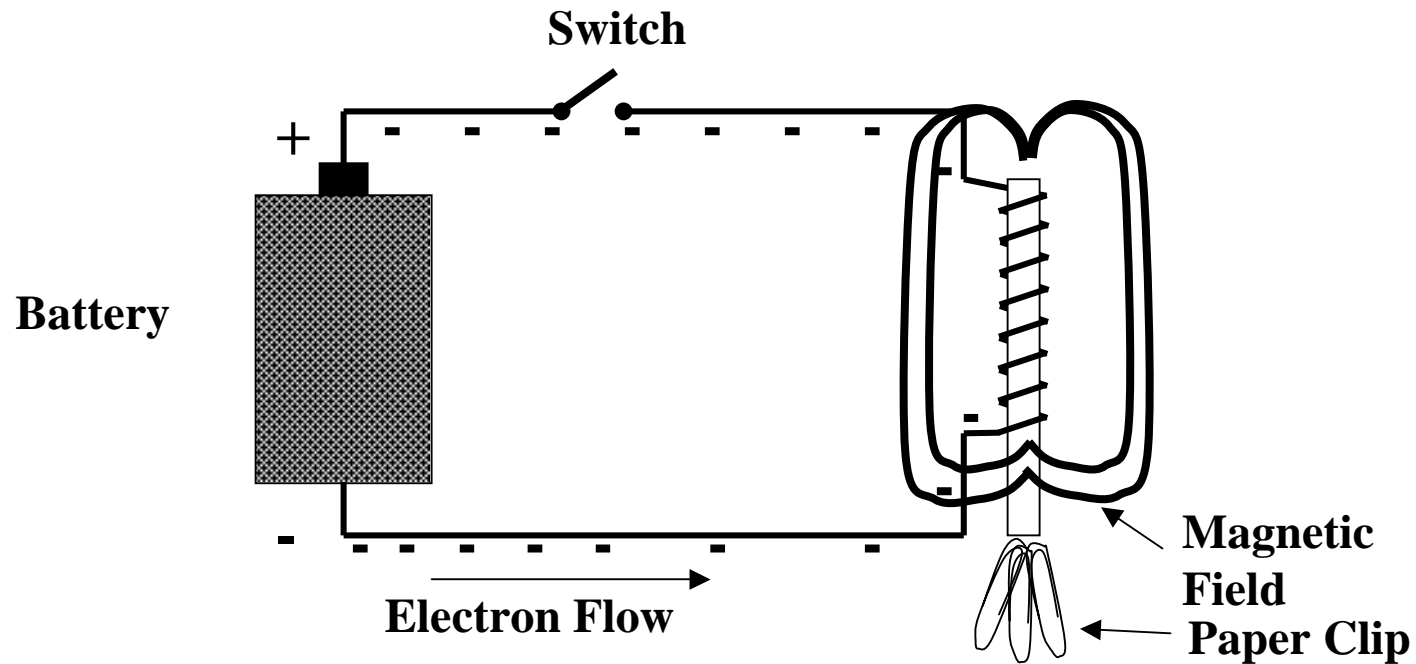
State the parts of the battery and how it works.

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## Electric Magnet



How does this work

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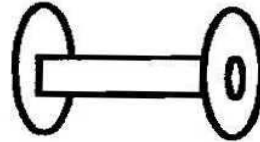
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## Build an Electric Magnet

Wire



Bobbin



Nail



Clips

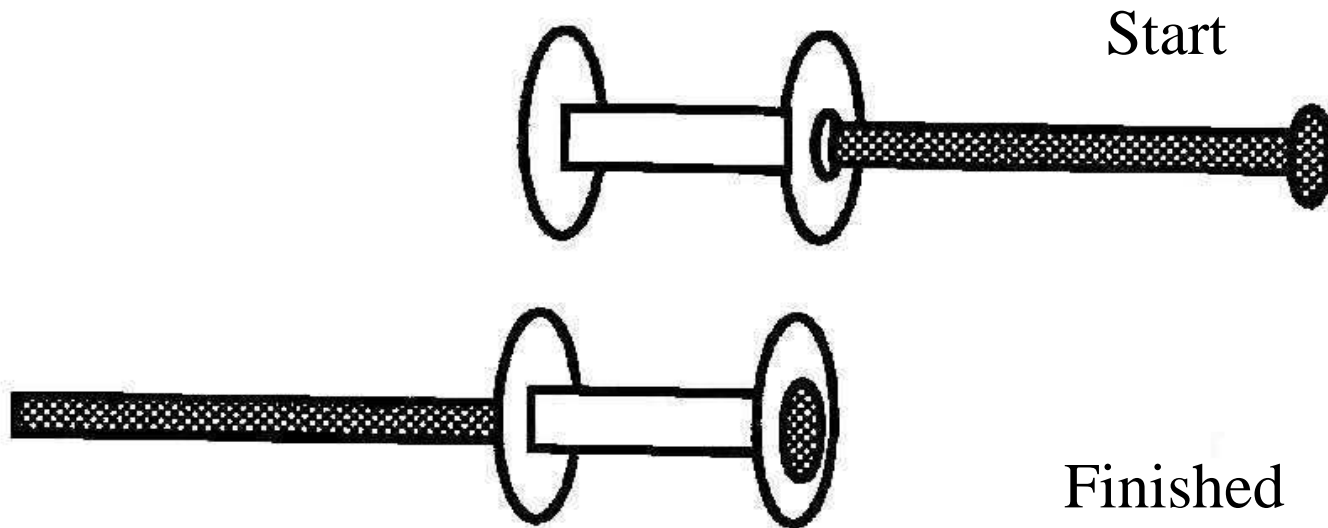


Distribute parts to each participant.

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## Build an Electric Magnet

### Slide Nail into Bobbin

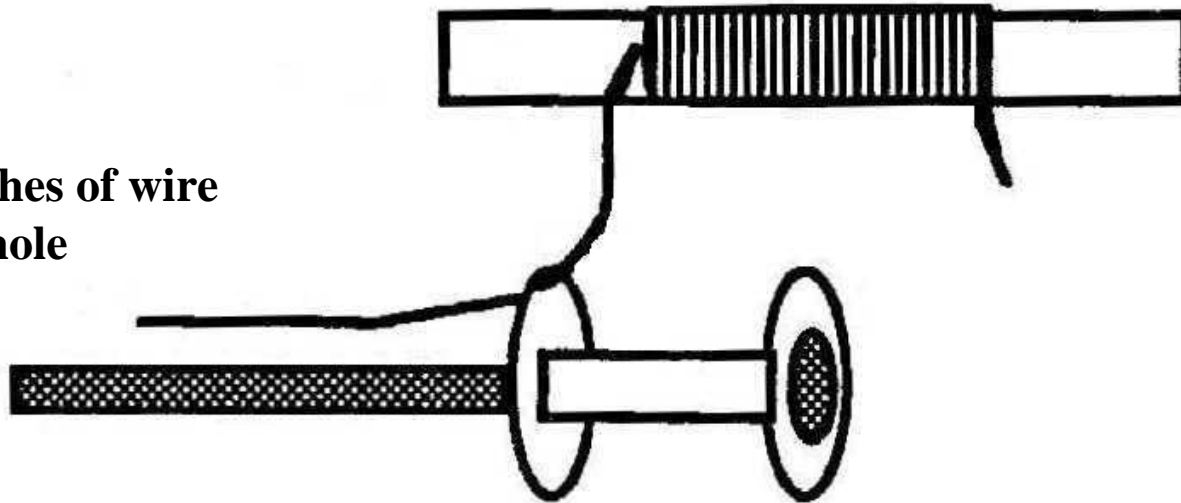


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## Build an Electric Magnet

Unwrap a small portion of the wire (6 inches) from the spool and pass it through the hole in the bobbin as illustrated.

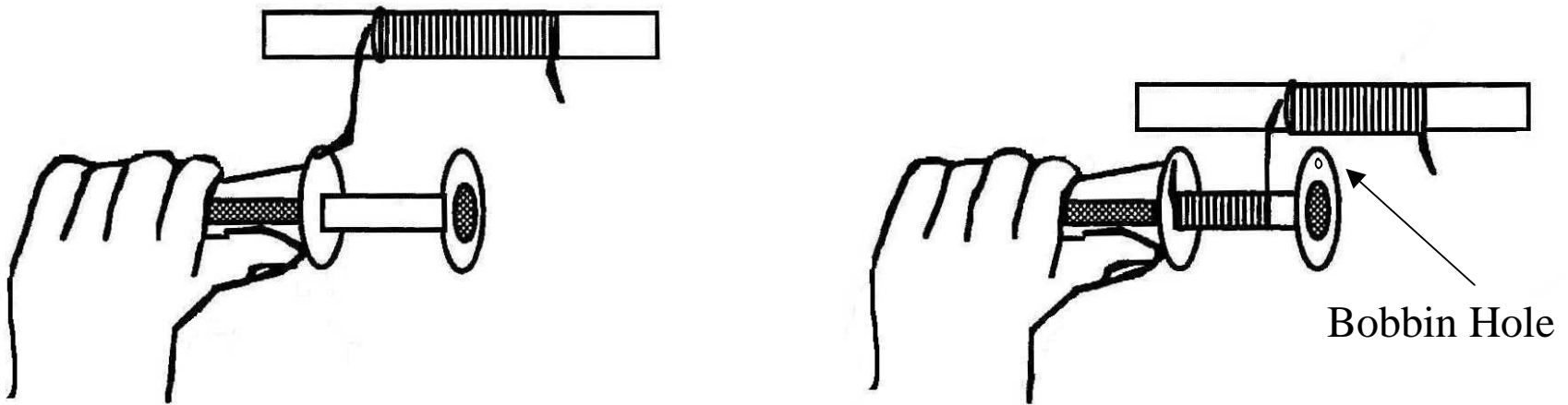
Pull 6 inches of wire  
through hole



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## Build an Electric Magnet

**Hold nail and wire in hand, pushing bobbin up against the nail head.  
This will prevent it from spinning when you wrap the wire around the bobbin.  
Now wind wire around Bobbin**

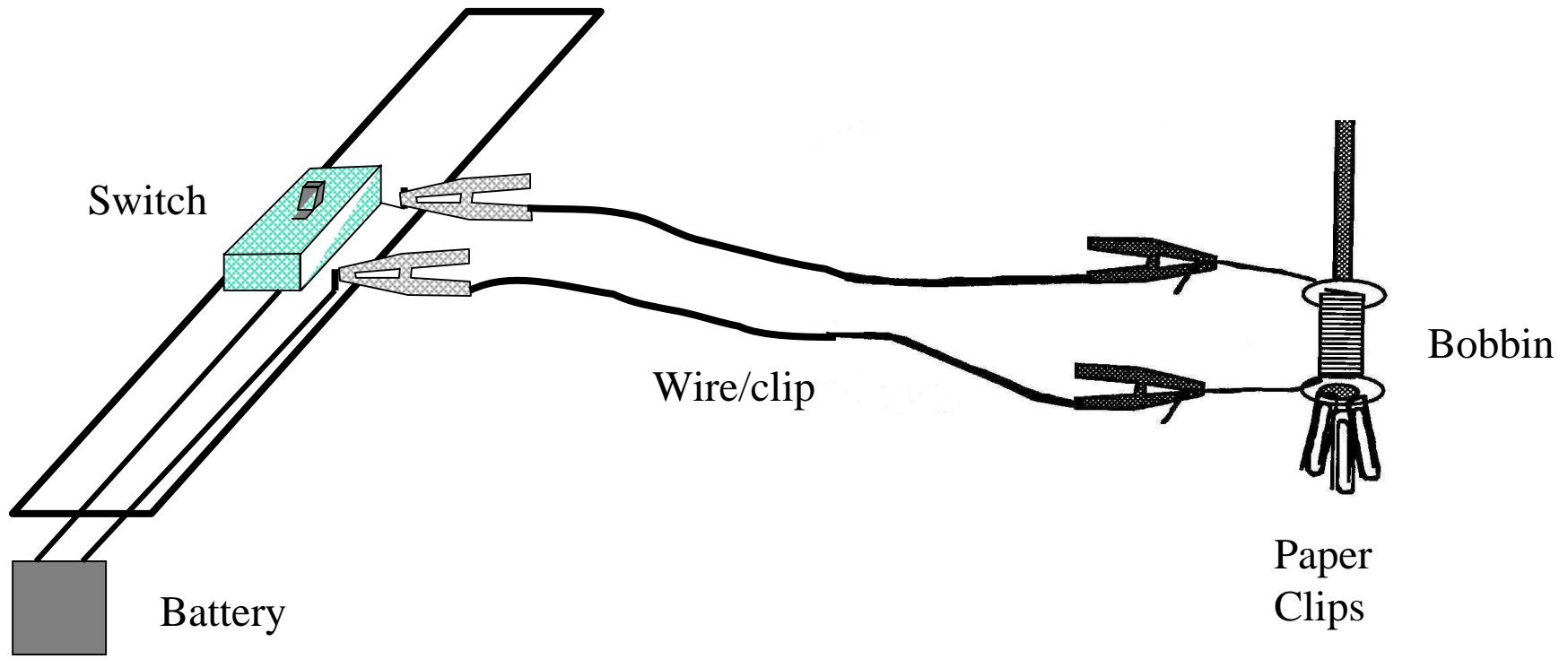


**When finished slide other end of wire through other hole in Bobbin.**

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## Build an Electric Magnet

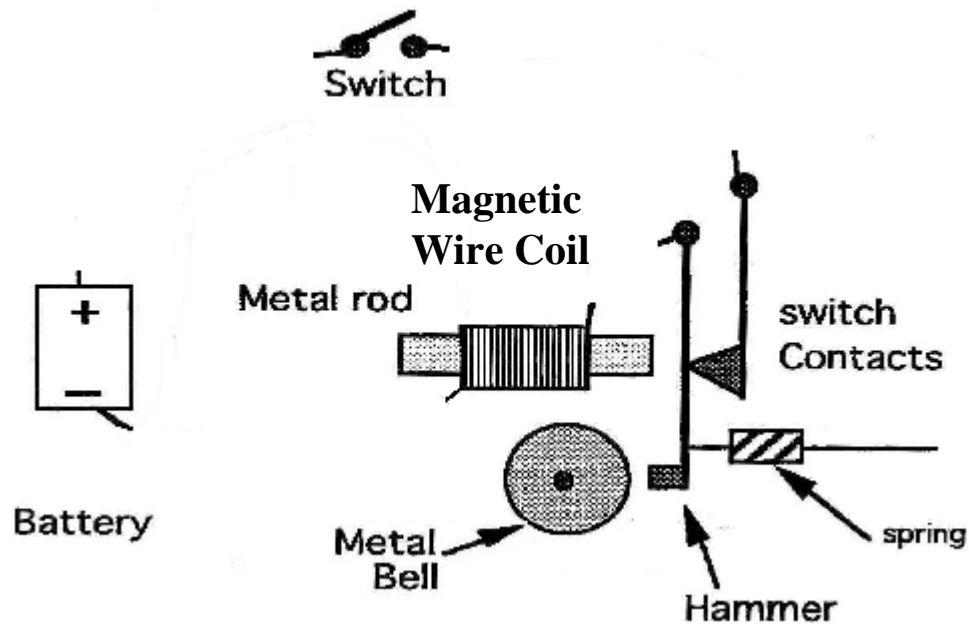
Connect the wire/clip from switch/board to bobbin wire as shown below. With nail head face down and close to paper clips, press switch to apply voltage to electric magnet. Raise nail from table and clips should be attached



# BSA Electricity Merit Badge

## Electric Magnet Makes Bell

Complete the electric magnet bell diagram then write how it works.



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