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6 per. STEM
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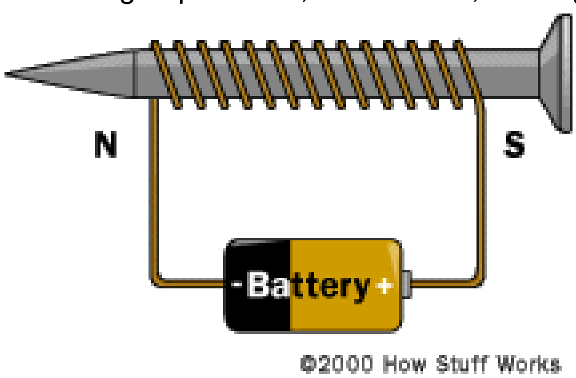
# STEM Lab Write-up

Objective: Following the overall question of how do electrical currents influence magnetic fields, we focused our research on how a different number of times copper wire is coiled affects the magnetic field

Background: What is an electromagnet? It is a magnet that is electrically powered. The dictionary definition is “a soft metal core made into a magnet by the passage of electric current through a coil surrounding it.” The electromagnet we made in our experiment was formed by taking a nail, wrapping wire around the nail at least 100 times, then attaching the ends of the wire  to 2 ends of a battery (see picture below). The reason our electromagnet works is that as the electricity flows through the wire, it creates a temporary magnetic field. It does this because as the electricity flows through the nail, it takes the usually random placement of atoms and moves a group of them, or a domain, into alignment with one another, creating a magnetic field.




https://science.howstuffworks.com/electromagnet2.htm

Hypothesis: If 32 gauge copper wire is wrapped around a 3 inch galvanized nail 100, 150, 200, and 250 times then the number of paper clips I can pick up with this electromagnet will increase as the coils increase

Procedure

**Materials**

32 gauge wire
3 inch galvanized nail
1.5 volt battery
Paper clips

**Procedure**

1. Gather all of your materials and stripp the ends of the 32 gauge isulated copper wire

2. Coil the 32 gauge insulated copper wire around the 3 inch galvanized nail 100 times, leaving a couple inches of wire on both ends.
3. Attach one end of the stripped wire to the positive side of the battery and the other end to the negative side of the battery.
4. Lay out 10-15 paper clips and record how many paper clips you are able to pick up
5. Repeat steps 2-4, except chang the number of coils to 150, then 200, and finally 250

Data

We created a Google spreadsheet with all our information. You can view it Here.

Analysis

When you take a look at our data, you can easily tell that as the number of times the wire is coiled around the nail increases, as do the number of paper clips that it can pick up increase(at 100 coils, there is an average of 1 paper clip being picked up, 4.6 at 150, 6.2 at 200 and 10.6 at 250.)Thus, as the number of coils increase, so does the strength increase, which is what our hypothesis was, showing we were right.

Conclusion

What I observed in this experiment is that when increasing the number of times 32 gauge wire is coiled around a 3 inch galvanized nail, from 100 to 250 you can increase the strength of the electromagnet. Our experiment involved creating an electromagnet by wrapping 32 gauge insulated copper wire around a nail multiple times (100, 150, 200, 250). We then stripped the ends of the wire, attached the ends to a battery and found out how many paper clips we could pick up with said electromagnet. As seen with our data, when we had wire coiled 100 times around our nail, we could only pick up an average of 1 paper clip. However, at 150 coils we could pick up an average of 4.6 paper clips, an average of 6.2 at 200 coils and 10.6 at 250 coils. The reason this works is because having our wire wrapped around our nail multiple times gave our nail a weak magnetic field, since the electrical field is the same as the magnetic field. However, this only worked with insulated wire. The reason this is the case is if we had uninsulated wire then the electricity will simply travel through the nail. However, with the insulated wire it will go around the nail multiple times, and then it will give some magnetism. As the coils increase, so does the amount of electricity flowing around the nail, and therefore increase the magnetism. So, in conclusion, increasing the number of times 32 gauge wire is coiled around a 3 inch galvanized nail, from 100 to 250 you can increase the strength of the electromagnet.