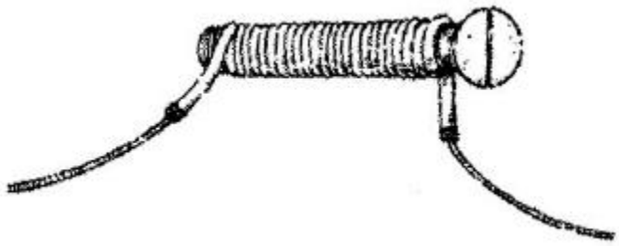
Electromagnetism

Purpose: to use electric current to make a simple electromagnet
to determine the effect of the number of loops of wire on the strength of an electromagnet

Materials: two wires with clips, steel bolt, about 1 meter of solid copper wire, 25+ staples, magnetic compass, 1 D-cell, 1 cell holder

What to do:



1. As you do the following, count how many times you wrap the wire. Wrap the wire tightly around the bolt at least 40 times leaving about 5 cm (2 in) of wire unwrapped at each end. Your wired bolt should look similar to the picture. Write down the number of times you wrapped the wire around the bolt.

Safety Note: Do not connect the wires to the cell longer than 15 seconds at a time.

2. Clip a wire to each end of the cell. Then clip the other end of each wire to the wire around the bolt. Current is now flowing through the wire. This is now an electromagnet.
What two types of force fields now exist around the wire?

3. Place the compass at the threaded end of the bolt, connect the cell.

(a) Which magnetic pole is the threaded end of the bolt?

(b) Quickly move the compass to the head of the bolt…which pole is it?

(c) Now switch the wires on the cell so that the current flows in the opposite direction through the wire. Identify the poles of the bolt again.

Have your work approved at this point.

4. Now you will try to pick up the staples with the magnetic force only. Spread the staples out on your lab table. Try not to let the staples hook each other as you pick them up, just the magnetism needs to do the lifting.
Reconnect the cell (no more than 15 seconds at a time) and start cleaning up the staples. First, try to pick up staples along the bolt where the wire is wrapped around it. Then try with the exposed end of the bolt.

(a) Which location picks up more staples…the ends or the wrapped part?

(b) What does the electromagnet do to the staples that allowed them to be picked up?

(c) What happened to the staples when the cell was disconnected?

Explain why this happened.

Have your work approved at this point.

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For the final part you will determine if the number of turns of wire affects the strength of the electromagnet.

5. Repeat the process from step #4 and record how many staples you can pick up with the exposed end of the bolt in your data table.

6. Tap the bolt on the table several times to reduce the bolt's temporary magnetism. Now unwind 5 turns of the wire from around the bolt and repeat step #5.

7. Continue this process until you have 5 or fewer turns of wire.

Have your data approved at this point.

8. Construct a graph of your data on the provided graph paper.

Number of turns of wire	***Number of staples picked up***

Final Question: Based on your graph explain the relationship between the number of turns of wire around the bolt and the strength of the electromagnet.