Activity 4: Electricity + Magnets = Electromagnets

How can you make a strong electromagnet?

Hypothesis

Predict: Using the images and information from the lesson Explore: Electricity + Magnets = Electromagnets, how can you make a strong electromagnet?

1. How could you increase energy?
2. How could you increase magnetism?

Materials

• Magnetic Kit Items: thin copper wire, battery holder, small bar magnet
• two AA batteries
• Additional Material: iron nail, paper clips, tape, (wide rubber band, sand paper)
• **ADLC Digital Lesson: Building an Electromagnet**
https://adlc.wistia.com/medias/2qxqsejup5

Method

Safety Warning: Wire can be sharp on the ends. Be careful not to poke yourself. Wire will get warm and may get HOT when connected to a battery. If wire gets hot, disconnect it from the battery immediately and allow it to cool. If you need help, ask an adult.

1. Use the thin copper wire from the ADLC kit.

2. Insert two batteries in the battery holder. (If you do not have a battery holder, stretch the wide rubber band over the ends of an AA battery.)

3. Wrap the thin copper wire around the nail twenty times so that it forms a coil around the nail. Be sure you leave at least 5 cm of wire free so that you can connect it to the battery.

4. Attach the ends of the copper wire to each end of the battery holder and attach to the battery.

(Or, if you do not use the wire from the ADLC kit, use sandpaper to remove the coating from about 1 cm at each end of wire. Slide the stripped ends of the wire under the rubber band on each end of the AA battery. By squeezing the outside of the rubber band against the battery, you can be sure the wire has good connection to each end of the battery. Use pieces of sandpaper to place between your fingers and the rubber band on each end of the battery. Safety: Be sure you are not touching the bare wire as you squeeze the elastic band. The wire will get warm; do not leave it connected for more than ten seconds. As

you squeeze with one hand to hold the wire connections tight, use your other hand to hold the nail and put the tip of the nail into the pile of paper clips. (Safety: When holding the nail, do not touch the wire.)

5. Use your hand to hold the nail and put the tip of the nail to the pile of paper clips. Slowly lift, and count any paper clips hanging from the nail that is now an electromagnet. If the nail does not attract any paper clips, check the wire connections and try again. Record your results in the *Electromagnet Strength Table* for Test A.

6. Repeat Steps 3 to 5, but use forty coils of wire instead of twenty. Record your results in the *Electromagnet Strength Table* for Test B.

7. Use tape to connect two AA batteries end to end. (Be sure you are connecting the positive end of one battery to the negative end of the other.)

8. Repeat Steps 3 to 5, but use the two batteries taped together with twenty coils of wire. Record your results in the *Electromagnet Strength Table* for Test C.

9. Repeat Steps 3 to 5, but use the two batteries taped together with forty coils of wire. Record your results in the *Electromagnet Strength Table* for Test D.

Observations

Electromagnet Strength Table

Type of Electromagnet	Strength
Test A: AA size battery, 20 coils of wire	
Test B: AA size battery, 40 coils of wire	
Test C: 2 AA size battery, 20 coils of wire	
Test D: 2 AA size battery, 40 coils of wire	

Conclusions

Look back at your hypothesis and think about the results of this activity. Write a statement that offers a conclusion about what you have learned about the strength of electromagnets.