Module 7: Current, Ohm's Law and Power

Topic 3 Application: Electric Charge and Current Scientific Investigation

Before you begin the scientific investigation below, make sure to download the Electric Charge and Current Scientific Investigation Report. As you complete this scientific investigation, fill in any needed information on the report template. If you need more information about each section of the report, please visit the Developmental Module.

Introduction

Do you remember playing with magnets as a child? Did you ever play with a really strong magnet that was difficult to separate from an object or from another magnet? Electricity and magnetism are closely related. This relationship allows us to make large magnets and to cause them to release their objects. Using a simple electromagnet, investigate the relationship between electricity and magnetism with respect to magnetic field, electric current, and nearby objects located within an electromagnetic field.

Objectives

In this scientific investigation, you will:

- build an electromagnet.
- measure magnetic strength.
- explore the relationship between electricity and magnetism with respect to magnetic fields, electric current and nearby objects located with an electromagnetic field.

Hypothesis

Using the Procedure and Data Collection section below, read through the procedural information for this scientific investigation. Based on your understanding of the procedure, develop your own hypotheses which describe your expected results. You should consider the following question: How can you strengthen the electromagnet? Record your hypotheses in the Hypothesis section of your Electric Charge and Current Scientific Investigation Report.

Equipment and Materials

- A large steel nail or bolt
- Approximately a meter of 22-gauge or larger insulated wire
- A new 1.5V-AA battery
- Small steel objects such as paper clips, metal thumb tacks, etc.
- Tape

Procedure and Data Collection

WARNING: The electromagnet you build in this scientific investigation will become hot during use. Be prepared to drop the electromagnet if it becomes uncomfortably hot. Never work near or with flammable materials. As always, use caution when handling devices which generate an electric charge. *Do not use a battery any larger than 1.5V.*

1. Leave about 8 inches of wire loose at one end and wrap most of the rest of the wire around the nail. Try not to overlap the wires. Wrap the wire at least 50 turns in the same direction around the nail.
2. Cut the wire (if needed) so that there is about another 8 inches loose at the other end.
3. Now remove about an inch of the plastic coating from both ends of the wire and attach one end of the wire to one end of a battery and the other end of the wire to the other end of the battery. It is best to tape the wires to the battery - *be careful, the wire could get hot.*
4. With your created electromagnet, put the point of the nail near one of your small steel objects and see what happens.

Data

Use the data table in the Data section of your Electric Charge and Current Scientific Investigation Report to record your data from this scientific investigation. What will happen when you bring your magnet in contact with several nearby steel objects? Make a prediction and then record your observations in the data table. The data table is also shown below:

Object	Prediction	Observation

Data Analysis

In the Data Analysis section of your Electric Charge and Current Scientific Investigation Report, provide responses to the following questions. Make sure to completely answer each question and to show all of your work.

1. Sketch or take a digital picture of your electromagnet.
2. Does the number of times you wrap the wire around the nail affect the strength of the electromagnet?
3. Does the thickness or length of the nail affect the electromagnet's strength?
4. Does the thickness of the wire affect the power of the electromagnet?
5. Devise a method to actually measure the magnetic strength. Investigate the relationship between direction of current and magnetic flux and explain why the magnet becomes hot.

Conclusion

Using the Conclusion section of your Electric Charge and Current Scientific Investigation Report, compose three to four sentences describing an overall conclusion based on your data. Were your hypotheses true or false, and how do you know? Analyze the magnetism of the nail with respect to presence and absence of electric current. Use the data and notes that you collected from your experience to form your conclusion. Make sure that you include information that you gained from data analysis to support your conclusion.

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Once you have completed the Electric Charge and Current Scientific Investigation Report, please submit your work to the dropbox.