  Investigation 24

Current from a Changing Field

Perhaps you have heard that light consists of electromagnetic waves. What does that mean? What is the relationship between the “electro” and the “magnetic”? While this may not be something you can solve today or even this week, this investigation should start you on the path to discovering this amazing connection.

Preliminary Observations

Observe the demonstration of a magnet moving relative to a coil of wire. What does the galvanometer do and what factors might affect the galvanometer reading?

Procedure

1. Discuss and decide on what variables you will use to explore the current generated in a coil of wire by a moving magnet. Remember that there can be only one dependent variable.
2. Develop a purpose and a procedure for your investigation.
   * Your purpose should ask a question or propose a relationship between variables.
   * Include the measurement equipment you will use.
   * Decide how much data or observation to take in order to have enough information to satisfy your purpose and stand up to questioning by your peers.
   * Remember to change only one independent variable at a time.
3. Carry out the investigation and record your data and observations. Make sure all group members have access to the data.

Analysis

Is the graph of the variables you measured a linear graph? Consider the range of data and the expected value of the dependent variable when the independent variable is zero. Also consider the uncertainty in your data. How well do you know the values you controlled and measured?

Develop a model for your data and discuss with your group how your variables fit into that model. When you discuss the results with your class, be sure to share your model and ideas. You may want to do some research on magnetic induction.

Extensions

1. A current in a wire generates a magnetic field. A changing magnetic field induces current in a wire. Use these principles to transfer energy wirelessly between two circuits, demonstrating that it works by lighting a small bulb or LED, or transmitting a sound signal.
2. Investigate flashlights and emergency radios that are charged by turning a crank or shaking. Explain how this works and build your own flashlight that works this way.
3. Investigate the role of transformers in electric power transmission, and build and demonstrate a small transformer. CAUTION: Do not work with household (mains) current. Use only a regulated laboratory power supply.