Lesson Plan 3: Faraday's Coil.

Go over the following vocabulary/pronunciation words, writing down important definitions on the board:

Michael Faraday
Electro-technology
Motor
Generator
Transformer
Apprenticed
Bookbinder
Royal Institution
Immerse
Chemistry
Analytical
Pulsating
Dynamo
Induce
Hampton Court

Read through the passage with the class. As a group, or in partners, conduct the experiment using the methods written. Once completed, the students should work on the Faraday comprehension worksheet. Once all groups are done, go over the results/conclusions. Be sure that everybody is clear on the concept of induced electricity by a magnet in a coil.

Michael Faraday (1791-1867)

Michael Faraday's work laid the foundations of electro-technology research. From his experiments came devices that led directly to the modern electric motor, generator and transformer.

Michael Faraday was born on 22nd September 1791. At the age of fourteen he was apprenticed to a London bookbinder. Reading many of the books in the shop, Faraday became fascinated by science, and wrote to Sir Humphry Davy at the Royal Institution asking for a job. On 1st March 1813, he was appointed laboratory assistant at the Royal Institution. There, Faraday immersed himself in the study of chemistry, becoming a skilled analytical chemist.

However, his greatest work was with electricity. In 1821, soon after the Danish chemist, Oersted, discovered the phenomenon of electromagnetism, Faraday began experiments to see if the opposite of Oersted's experiment could be produced: that electric current could be produced in a wire using a magnetic field. When Faraday thrust a magnet into a coil of wire, electricity flowed one way through the wire. When the magnet was moved out of the coil, the electricity flowed in the opposite direction. When he moved the magnet in and out, a regular, but pulsating, current was produced. He also discovered that moving the magnet over or under the coil made the current.

This discovery is still used today in things such as dynamo lights for bicycles (powered by the movement of the spinning wheels), and in power plants, in which turbines are moved to induce electric current in wires. The alternating current is used in our homes even today.

Faraday continued his electrical experiments. In 1832 he proved that the electricity induced from a magnet and static electricity were all the same.

Faraday's 1st induction ring

In 1865, Faraday ended his connection with the Royal Institution after over 50 years of service. He died at his house at Hampton Court on 25th August 1867.

Faraday worksheet

1. When was Michael Faraday born?
2. How old was he when he worked as a bookbinder?
3. What did he enjoy reading about?
4. When did he begin working at the Royal Institution?
5. What work did he do there?
6. Whose discovery in 1821 fascinated Faraday and made him investigate electro-magnetic properties?
7. Name one invention that utilizes Faraday's ideas.
8. What did Faraday prove were the same thing in 1832?
9. When did he end his work at the Royal Institution?
10. When and where did Faraday die?

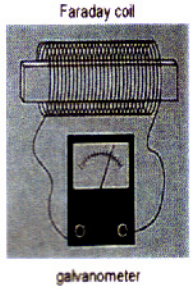
Reproduce Faraday's discovery

You will need:

- One bar magnet.
- Several meters of insulated wire.
- Toilet roll or PVC pipe large enough to insert the bar magnet.
- Galvanometer (detects current and direction of current flow).

Method:

1. Scrape the ends of the wire to remove insulation.
2. Wind the wire 20 to 30 times around the toilet roll/PVC pipe to form a coil. (See diagram).
3. Connect the wire to the galvanometer.
4. Push the bar magnet into the coil. Observe what happens on the galvanometer.
5. Pull the magnet back out of the coil. Observe what happens on the galvanometer.
6. Try moving the magnet over and under the coil. Observe what happens.
7. Move the magnet at different speeds and observe what happens.
8. If you have time, repeat the experiment with different numbers of loops. Does this result in a difference in the galvanometer reading?



Results: Write down your observations for each part of the experiment.

Conclusion: Write about what you think is happening in this experiment.

Lesson Plan 4: constructing an electromagnet

Students will follow the method for making an electromagnet. They will then use implied knowledge and ideas to try and create a stronger electromagnet. If you are doing this as a competition, you may want to set a time limit for discovery. About 20 minutes after their first trial should be sufficient.

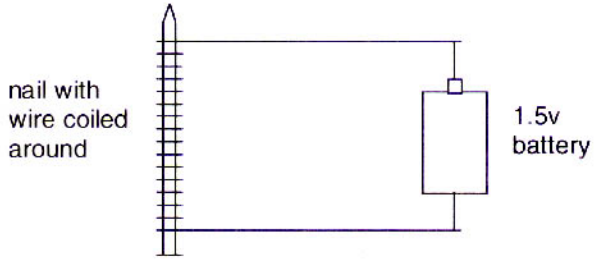
You will need:

-one 1.5v battery with holder
-spool of conducting wire (may use multiple sizes for the extension)
-various nails (may use different materials or different sizes)
-paper clips of the same size for testing the magnet

Method:

1. Coil the wire around a nail.
2. Remove the insulation from the wire ends.
3. Attach the wire ends to the battery.
4. Pick up paper clips using the electromagnet.
5. Record the information about the test in the given chart.
6. Repeat and try to find the strongest electromagnet through repeat trials.

Diagram:



Results: complete the following table

Nail properties (size, material, etc.)	# of coils	# paperclips picked up

Conclusion:

Write to explain which of your electromagnet set-ups picked up the most paperclips. Also, think about and write to tell your ideas of how to make the electromagnet even stronger. Finally, think about what applications in the real world this invention has.