MAGICAL MAGNETS MAKE ELECTRICITY

GRADES 3 - 5

SOUTHERN COMPANY

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MAGICAL MAGNETS

SNC - Plant Farley

LESSON PLAN

MAKE ELECTRICITY

Lesson Title: Magical Magnets Make Electricity

Lesson Description: Students conduct experiments using magnets to gain an understanding of the relationship between magnets and electricity and to understand how generators produce electricity.

Grade Level: 6-8 (modify as needed for each grade level)

Subject Area(s): Physical Science, Earth Science

Objectives: Students will
- gain an understanding of the concept that magnets and electricity are related forms of energy
- become familiar with terms relating to electricity
- construct a model of a simple generator
- gain an understanding of how generators produce electricity
- use a galvanometer to monitor electrical current

Materials:
- 8 and 16 foot (approximate) lengths of insulated bell wire
- galvanometers
- small bar magnets
- large bar magnets
- large horseshoe magnets
- short lengths (6-8") of dowel rods with diameters slightly larger than the small and large bar magnets (you will need 2 different diameters of dowels, one for each size of bar magnet)
- pencils
- activity sheets

Correlations (NSES):
- Content Standard A - Science as Inquiry
  - develop abilities to do scientific inquiry
  - develop understandings about scientific inquiry
- Content Standard B - Physical Science
  - develop an understanding of properties and changes of properties in matter
  - develop an understanding of transfer of energy
- Content Standard E - Science and Technology
  - develop abilities technological design
  - develop understanding about science and technology
- Content Standard F - Science in Personal and Social Perspectives
  - develop understanding of science and technology in society

Curriculum Integration:
- Technology (power production)
- Vocational Education (electricity, motors)
- Environmental Science (power production, energy consumption)

Process Skills:

- Observation
- Comparison
- Collection of data
- Measurement
- Counting
- Research
- Inference
- Investigation/experimentation
- Interpretation of data
- Analysis of data
- Description of findings
- Communication of ideas
- Construction of model

Background Information:

- Main ideas

  Principles related to electricity and magnetism such as:

  - the flow of electrons through a conductor is electric current
  - electricity and magnetism are related forms of energy
  - magnetic fields surround magnets
  - electricity
  - uses/operation of a galvanometer
  - additional principles such as voltage, amperes, Ohm's Law, etc. may be discussed if so desired
  - the current produced by the device students construct is the same manner in which generators produce electricity

  Principles related to power production

  • Secondary ideas

  - Energy consumption/production methods
  - Measurement of electrical energy
  - Historical figures such as H. Oersted, J. D'Arsonval, J., Schweigger, etc.

Teacher Activities:

- Assemble/organize all materials needed for activity.
- Check galvanometers to make certain they are working properly.
- If you don't have galvanometers, you can modify the exercise by using a compass to detect electrical current.
- Present background material to students.
- Issue instructions on how to use/read a galvanometer for this exercise.
- Depending on the size of the class, the teacher may wish to divide the class into groups or 2-4 students. Each student in the group should have a specific task is the exercise.
- Issue instructions to students regarding experiment.
- Distribute Activity Sheets to students and give instructions on how to complete them.
- Monitor/assist students as needed during exercises
- After students complete exercises and assemble back into a group, allow students to show their work and describe their observations.
- After students have shared their work, engage students in post-activity discussion. Stress main points of lesson during discussion.

Student Activities:

- Listen to background information given by teacher
- Obtain all materials needed to complete the exercise (refer to Activity Sheet)
- Record preliminary data on Activity Sheets
- Construct generator models as directed in Activity Sheets
- Observe results and record data
- Interpret/analyze data and share it with other students
- Participate in post-activity discussion

Evaluation:
- Activity sheets
- Direct observation
- Oral reports from students

Extension/Enrichment:
- Have students utilize different types/sizes of magnets
- Have students attempt to power a small LCD thermometer with a larger “generator” they construct
- Vary wire composition, diameter, etc. and note differences in current production
- Have students make their own magnets
- Have students make electromagnets
- Arrange a field trip to a power production facility to see how electricity is produced commercially

Safety Considerations:
- Caution students to handle equipment (galvanometers) with care to prevent breakage.

MAGICAL MAGNETS

ACTIVITY SHEET

MAKE ELECTRICITY

(READ THIS ENTIRE SHEET BEFORE BEGINNING THE EXERCISE)

Introduction:

In this lab activity, you will measure a weak electrical current produced by a model of a generator. It is amazing that fruit can generate electricity using only magnets and wire, but it is true, as you will prove in this exercise. The models you construct operate on the same principles as the giant generators used in plants that produce electricity.

Hopefully, you will be able to see some basic principles regarding electricity and magnetism discussed prior to the laboratory exercise. Follow the directions on this Activity Sheet and record your data carefully and accurately, as you will be called upon to relay your findings to the rest of the class after the lab is completed.

Procedure:

Obtain the following materials as directed by your instructor:

- 2 different lengths of bell wire (an 8 foot length and a 16 foot length)
- a galvanometer
- two sections of dowel rods of two different diameters
- 2 sizes of bar magnets
- a large horseshoe magnet
- Pencil

- Take the eight-foot section of bell wire and wrap it around the smaller diameter wooden dowel to form a tight coil. Slip the coil off of the dowel.

- Strip about 1 inch of insulation off of each end of the wire coil. Attach the bare ends to the galvanometer. Obtain a reading on the galvanometer and record the data in Table 1.

- Use one hand to insert a bar magnet through the wire coil. Observe the galvanometer. Answer question 1 on the Activity Sheet.

- Pull the small bar magnet out and observe the galvanometer. Answer question 2 on the Activity Sheet.

- Move the small bar magnet in and out of the coil very quickly so that the magnet is in continuous motion for several seconds. Observe the galvanometer and record data in Table 1.

- Have one of your lab partners hold the small bar magnet stationary and another move the wire coil very rapidly over it. Answer question 3 on the Activity Sheet.

- Move the bar magnet back and forth along the sides of the coil. Obtain galvanometer readings and record data in Table 1.

- Repeat the same process using the longer piece of wire, bigger diameter dowel, and larger bar magnet. Record data in Table 1 and answer question 4 on the Activity Sheet.

- Now move the large horseshoe magnet back and forth along the sides of the small wire coil. Observe galvanometer and record your data in Table 1.

Procedure (continued):

- Move the same large horseshoe magnet along the sides of the large wire coil. Make observations and record data in Table 1.

- Analyze your data and answer the remaining questions on the Activity Sheet .

- Present you findings to the class and compare your data/findings with that of other students.

Questions:

1. What happens to the galvanometer reading when the bar magnet is moved into (through) the center of the wire coil?

2. What happens to the reading when the magnet moves back out of the coil? Does the reading change when the magnet is held still?

3. Is the reading on the galvanometer the same when the coil is moved as when the magnet is moved? If there is a difference, which type of movement produces the highest reading, wire coil movement or magnet movement? Why do you think this is so?

4. Compare the results using the larger coil and magnet to that of the smaller ones. Are the results the same or different? How are they different?

5. Compare the readings using the large horseshoe magnet to those obtained with the bar magnets. Are the readings the same or different. Explain your findings.

Table 1 – Galvanometer Readings

TYPE OF MAGNET AND COIL	PLACED INTO CENTER OF COIL	MOVED OUT OF COIL CENTER	CONTINUOUS MOVEMENT THROUGH COIL	MOVEMENT ALONG SIDES OF COIL
Small Bar & Coil				
Large Bar & Coil				
Horseshoe & Small Coil				
Horseshoe & Large Coil				