MAGNETS AND ELECTRIC CURRENTS

Prep Time: 15 minutes
Teaching Time: 1½ hours

INSTRUCTIONS
Grade 7

Science Teacher Education Program

Science Concept:

Passing a magnet through copper coils can produce electric currents.

Objectives:

The student will:

- explain an electric current is produced when a magnet is moved through coils of copper wire;
- collaborate with a group to design an experiment;
- conduct a controlled experiment that tests a single variable; and
- communicate experimental procedures and conclusions in a lab report.

GLEs Addressed:

Science

[7] SA1.2 The student demonstrates an understanding of the processes of science by collaborating to design and conduct simple repeatable investigations, in order to record, analyze (i.e., range, mean, median, mode), interpret data, and present findings.

[7] SB4.2 The student demonstrates an understanding of motions, forces, their characteristics, relationships, and effects by recognizing that electric currents and magnets can exert a force on each other.

Writing

[7] W3.2.2 The student writes for a variety of purposes and audiences by writing in a variety of nonfiction forms (e.g. letter, report, biography and/or autobiography) to inform or describe.

Vocabulary:

amperes- a unit for measuring the rate of flow of an electric current

electric current- the flow or movement of electric charge

Faraday's Law- (Physics) Faraday's Law relates the voltage produced in a coil in a magnetic field to the number of loops in the coil, the change in magnetic flux, and the time to carry out the change

voltage- the difference in electrical energy between two points, measured in volts

Materials:

- Simple hand-cranked generator with an LED and/or radio with a dynamo (students should be able to see the turning magnet inside a coil producing electricity)
- Faraday's Electromagnetic Induction Experiment Kit (Faraday's Electromagnetic Induction Experiment Kit from Science Kit & Boreal Laboratories, Part No. 68145-00) (one per group)
- Different strength bar magnets

Activity Procedure:

Gear Up

Process Skills: observing and communicating

1. Ask students what they know about lights and radios and record all responses on the board. Make sure that students know both lights and radios need electricity to operate.
2. Show students the generator with LED or radio with crank, noting that neither has a place to put in batteries. Turn the generator or radio crank so either the LED or the radio turns on.
3. Ask students how the LED or radio turned on. After students have given their responses, move on to the exploration.

Explore

Process Skills: observing, collecting data, and communicating

4. Show students the different parts of Faraday's Kit: coils, galvanometer, and electric circuit. Explain a galvanometer measures the amount of current in milli-amperes (mA) running through the copper wire. Amperes are a unit measure of the amount of current (milli- 1/1000th).
5. Direct groups of three to five students to explore by passing different strength magnets through the coils. Students should record the results of their exploration for each magnet and coil on a sheet of paper.

Generalize

Process Skills: communicating

6. As a class, discuss student discoveries during their explorations and compare results from each group on an overhead or on the board.
7. Ask students what they can infer from passing a magnet through a coil. Ask them to think back to the light or radio and suggest a means by which it receives power.

Experiment

Process Skills: hypothesizing, investigating, and collecting data

8. Ask students to collaborate with their groups to design and conduct an experiment to determine the effect of passing a magnet through a coil.
9. Direct students to develop and write a testable question, an "if/then" hypothesis, and a list materials and procedures that test the hypothesis. Review each group's question, hypothesis, materials, and procedures for approval.
10. Direct groups to perform their experiment and record all data.

Interpret

Process Skills: graphing, investigating, interpreting, and communicating

11. Assign students to write a lab report, which includes the following sections: introduction with hypothesis, materials and procedures, data table(s) and graph(s), discussion, and conclusion(s). The discussion and conclusion sections should be supported by data.
12. As a class, compare and contrast each group's findings.

Apply/Assess

Process Skills: investigating, communicating

13. Direct students to research real-life applications of magnetic fields to make an electric current and then list three devices that use the concept.

Extension Ideas:

Students can build their own generators to see if they can generate over two volts.
If generators produce the power for the community, arrange a tour of a local generator, if possible.

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Objective	GLE	Emergent	Developing	Proficient	Advanced
The student collaborates to design an experiment.	SA1.2	The student did not write a hypothesis or explain how to test it.	The student wrote a hypothesis that is unrelated to the testable question or not tested by the experimental procedure.	The student wrote a hypothesis that is related to the question. The experiment procedures are controlled.	The student has completed all the requirements for "Proficient" and incorporated materials that explore them more accurately or more deeply.
The student conducts a controlled experiment that tests a single variable.	SA1.2	Variables are not controlled and data is not measured correctly or recorded.	Some variables are not completely controlled to the best of student's ability, and data is measured and/ or recorded inaccurately.	Variables are controlled to the best of student's ability and data is measured and recorded accurately.	The student demonstrates proficiency by controlling variables and taking precise measurements (to tenths of units).
The student explains an electric current is produced when a magnet is moved through coils of copper wire.	SB4.2	The student does not explain basic content or concepts even after peer and/or adult help.	The student explains basic content or concepts with or without peer or adult help, but major errors are present.	The student explains basic content and concepts. Minor errors are present but do not detract from the overall response.	The student's explanation demonstrates a proficient understanding of basic content and concepts and applies new ideas to everyday life.
The student communicates the experimental procedure and conclusions in a lab report.	W3.2.2	No lab report is turned in or sections are missing or incorrectly labeled.	The lab report includes all required sections, but sections are not labeled properly.	The lab report is complete and labeled properly.	The lab report is complete and labeled properly and also includes a simple abstract, title page, and/or illustrations.