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SciQuest®

• Observe • Question • Think • Measure • Predict

Electromagnetism And Current Electricity Multi-Group Kit

by Carl Pfeiffer

TABLE OF CONTENTS

Page

CURRENT ELECTRICITY

Page

ELECTROMAGNETISM

Page

ANSWER KEY

Page

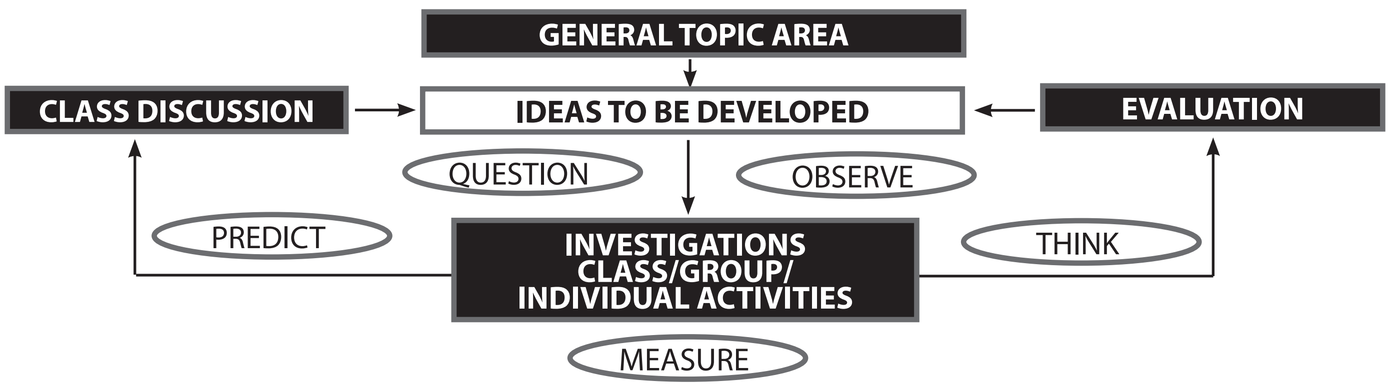
INTRODUCTION TO TEACHERS

Your SciQuest® Multi-Group Kit has been especially designed to enable you to incorporate a wide range of unique and interesting "hands-on" investigative activities into your existing science program.

The SciQuest® topic areas are designed to make it easy for you to match the specific topics and ideas to be developed, through the investigations the kit provides, to the topics and ideas associated with the scope and sequence which makes up your current science program.

When used in conjunction with your "in-place" curriculum, your SciQuest® Kit and Teacher's Guide will help you to add a meaningful and exciting dimension to the teaching/learning opportunities you provide for your students.

MODEL FOR IMPLEMENTATION



Each specific activity level topic is described in terms of a set of "Ideas to Be Developed." The teaching strategy intended is that these "Ideas to Be Developed" become the focal point of the investigations, activities, and class discussions.

Your Teacher's Guide includes blackline masters for producing copies of the Data Sheets for your students. For some activities and investigations, you may want to produce copies of the Teacher's Guide for your students as well.

As you become more familiar with your SciQuest® Kit, you will probably find that there are certain activities which you will want to have your students do on an individual basis or in small groups. The additional equipment and/or materials that are required to do this can be ordered from Nasco as separate items. It is in situations where you have your students working individually or in small groups that you will most likely want to produce copies of your Teacher's Guide for your students to use.

Remember, science is a "quest" to develop an understanding about the world around us. It is a "quest" which provides unique opportunities to develop learning skills in observation, questioning, measuring, predicting, and thinking. Best of all, it is fun for you and your students!

We hope that you and your students enjoy using these materials.

Sincerely yours,

Carl Pfeiffer

Each SciQuest® kit is custom designed and developed to allow you to easily incorporate Educational Standards. The Electromagnetism and Current Electricity Multi-Group Kit **SB15342** satisfies the following:

3. Forces and Interactions

Students who demonstrate understanding can:

3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Asking Questions and Defining Problems • Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3)	**PS2.B: Types of Interactions** • Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3-PS2-3), (3-PS2-4)	**Cause and Effect** • Cause and effect relationships are routinely identified, tested, and used to explain change. (3-PS2-3)

Common Core State Standards Connections:

ELA/Literacy

RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. *(3-PS2-3)*

Mathematics

MP.2 Reason abstractly and quantitatively. *(3-PS2-1)*

3-5. Engineering Design

Students who demonstrate understanding can:

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. (3-5-ETS1-3) **Constructing Explanations and Designing Solutions** • Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. (3-5-ETS1-2)	**ETS1.B: Developing Possible Solutions** • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2) • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2) • Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3) **ETS1.C: Optimizing the Design Solution** • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3)	**Influence of Science, Engineering, and Technology on Society and the Natural World** • Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)

Common Core State Standards Connections:

<u>Mathematics</u>

MP.2 Reason abstractly and quantitatively. *(3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3)*

MP.5 Use appropriate tools strategically. *(3-5-ETS1-1), (3-5-ETS1-2), (3-5-ETS1-3)*

4. Energy

Students who demonstrate understanding can:

4-PS3-2. Make observation to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric current.

4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations • Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (4-PS3-2) **Constructing Explanations and Designing Solutions** • Apply scientific ideas to solve design problems. (4-PS3-4)	**PS3.A: Definitions of Energy** • Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2), (4-PS3-3) **PS3.B: Conservation of Energy and Energy Transfer** • Light also transfers energy from place to place. (4-PS3-2) • Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4-PS3-2), (4-PS3-4) **PS3.D: Energy in Chemical Processes and Everyday Life** • The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4)	**Energy and Matter** • Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2), (4-PS3-3), (4-PS3-4) ***Connections to Engineering, Technology, and Applications of Science*** **Interdependence of Science, Engineering, and Technology** • Knowledge of relevant scientific concepts and research findings is important in engineering. (4-ESS3-1) ***Connections to Nature of Science*** **Science is a Human Endeavor** • Most scientists and engineers work in teams. (4-PS3-4) • Science affects everyday life. (4-PS3-4)

Common Core State Standards Connections:

<u>Mathematics</u>

MP.2 Reason abstractly and quantitatively. *(4-ESS3-1)*

MS. Forces and Interactions

Students who demonstrate understanding can:

MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Asking Questions and Defining Problems • Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. (MS-PS2-3) - ***Connections to Nature of Science*** **Scientific Knowledge is Based on Empirical Evidence** • Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS2-2), (MS-PS2-4)	**PS2.B: Types of Interactions** • Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3)	**Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS2-3), (MS-PS2-5)

Common Core State Standards Connections:

ELA/Literacy

RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. *(MS-PS2-1), (MS-PS2-2), (MS-PS2-5)*

Mathematics

MP.2 Reason abstractly and quantitatively. *(MS-PS2-1), (MS-PS2-2), (MS-PS2-3)*

MS. Engineering Design

Students who demonstrate understanding can:

MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data • Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3)	**ETS1.B: Developing Possible Solutions** • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3) • Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3) **ETS1.C: Optimizing the Design Solution** • Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process — that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3)	**Influence of Science, Engineering, and Technology on Society and the Natural World** • The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)

Common Core State Standards Connections:

ELA/Literacy

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). *(MS-EST1-3)*

RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. *(MS-ETS1-2), (MS-EST1-3)*

Mathematics

MP.2 Reason abstractly and quantitatively. *(MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3), (MSETS1-4)*