May Grade 7 1B: Electricity and Magnetism Relationship

Content Area: **Science**
Course(s):
Time Period: **May**
Length: **3 Weeks**
Status: **Published**

Unit Overview

Wrap a wire around a nail and hook its ends to a battery: You will generate a magnetic field that makes the nail a magnet. In this concept, you will learn how electricity and magnetism are related.

Enduring Understandings

- **Lesson Objectives**

  By the end of the lesson, students should be able to:

  - Describe the relationship between magnetism and electricity.
  - Explain how the size of the wire, the strength of the magnet, and the amount of mechanical energy used all affect the amount of electricity produced by a generator.

Essential Questions

- **Overarching Question**

  - How can one explain and predict interactions between objects and within systems of objects?

- **Focus Question**

  - What underlying forces explain the variety of interactions observed?

- **Lesson Questions**

  - How are electricity and magnetism related?
  - How can mechanical energy, electric forces, and magnetic forces be used to generate electricity?
  - What factors affect the strength of electric and magnetic forces in a generator?

- **Can You Explain?**

- How can an electrical current produce a magnetic field, and how can a magnetic field produce an electrical current?

Instructional Strategies & Learning Activities

DISCOVERY TECHBOOK LESSONS:

The Five E Instructional Model

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  - Science Techbook follows the 5E instructional model. As you plan your lesson, the provided Model Lesson includes strategies for each of the 5Es.
  - Engage (45–90 minutes)

    Students are asked to examine electricity and magnetism in roller coasters. Students begin to formulate ideas around the CYE question.
  - EXPLORE (120 minutes)

    Students learn about how electricity and magnetism are related, how they are used to generate electricity, and factors that affect their strength. They also complete labs where they build an electromagnet and detect magnetic fields.
  - EXPLAIN (45–90 minutes)

    Students construct scientific explanations to the CYE question by examining how electricity and magnetism affect one another.
  - ELABORATE with STEM (60–135 minutes)

    Students apply their understanding of electricity and magnetism to real-world problems and innovations. They research common uses for electromagnets and analyze wind-power generators.
  - EVALUATE (45–90 minutes)
  - Students are evaluated on the state science standards, as well as Standards in ELA/Literacy, and Standards in Math standards using Board Builder and the provided concept summative assessments.

- Teacher-made labs using electrical supplies and manipulatives
- Online simulations
- Group project

Integration of Career Exploration, Life Literacies and Key Skills

The students will demonstrate 21st Century Skills through working in a group to design, plan, build, and present a lighting device or decoration. The students will play the roles of project leaders, engineers, developers, marketers, and sales representatives for their product.

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.
TECH.9.4.8.TL.3	Select appropriate tools to organize and present information digitally.
TECH.9.4.8.IML.5	Analyze and interpret local or public data sets to summarize and effectively communicate the data.
	Digital tools make it possible to analyze and interpret data, including text, images, and sound. These tools allow for broad concepts and data to be more effectively communicated.
	An individual's strengths, lifestyle goals, choices, and interests affect employment and income.
	Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking.
	Increases in the quantity of information available through electronic means have heightened the need to check sources for possible distortion, exaggeration, or misrepresentation.
	Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others.

Technolgy Integration

-Use of Google Chrome Books

-online interactives in D.E.

-ExploreLearning.com Gizmos

-Nearpod

-Google Slides

-The students will be using electrical supplies and craft supplies to create their own lighting device as a group.

They will utilize the engenering and design process and present their finished device.

-Labs demonstrating concepts in electricity and magnetism

TECH.8.1.8.A.CS2	Select and use applications effectively and productively.
TECH.8.1.8.B.CS2	Create original works as a means of personal or group expression.
TECH.8.1.8.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.
TECH.8.1.8.F.CS1	Identify and define authentic problems and significant questions for investigation.
TECH.8.1.8.F.CS2	Plan and manage activities to develop a solution or complete a project.
TECH.8.1.8.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.
TECH.8.2.8.C.1	Explain how different teams/groups can contribute to the overall design of a product.
TECH.8.2.8.C.2	Explain the need for optimization in a design process.
TECH.8.2.8.C.CS1	The attributes of design.
TECH.8.2.8.C.CS2	The application of engineering design.
TECH.8.2.8.D.1	Design and create a product that addresses a real world problem using a design process under specific constraints.
TECH.8.2.8.D.2	Identify the design constraints and trade-offs involved in designing a prototype (e.g., how the prototype might fail and how it might be improved) by completing a design problem and reporting results in a multimedia presentation, design portfolio or engineering notebook.
TECH.8.2.8.D.3	Build a prototype that meets a STEM-based design challenge using science, engineering, and math principles that validate a solution.

Interdisciplinary Connections

LA.RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
LA.RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
LA.RST.6-8.3	Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
LA.RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.
LA.RST.6-8.5	Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
LA.RST.6-8.6	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.
LA.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).
LA.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
LA.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.

LA.RST.6-8.10	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
LA.WHST.6-8.1	Write arguments focused on discipline-specific content.
LA.WHST.6-8.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.6-8.4	Produce clear and coherent writing in which the development, organization, voice, and style are appropriate to task, purpose, and audience.
LA.WHST.6-8.5	With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
LA.WHST.6-8.6	Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.
LA.WHST.6-8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
LA.WHST.6-8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
LA.WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research.
MA.7.EE.B	Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

Differentiation

See differentiation suggestions in the above lessons.

Differentiation Strategies

Struggling Students

1. Remind students that good readers often read a text three times in order to understand the content at a deeper level.
2. Have students use the Listen feature of the reading passage.
3. Break the video segments into small pieces, stopping at important points and repeating segments, if necessary, to allow students time to jot down their information. Also, discuss each segment of the videos with the class rather than waiting until the end of the videos.

ELL

1. Have students use the Speak, Text, and Listen tools to reinforce pronunciation as they read.
2. Remind students that they can use the closed-captioning function to help them understand the narration as they view the video segment.
3. Pair ELLs with accelerated students. Have students rephrase the narration in the video.

Accelerated Students

1. Challenge students to use Board Builder to show the direct relationship between magnet strength and amount of electricity produced in a generator—using examples, graphics, and videos.
2. Challenge students to construct a second electromagnet with a revised design and compare and contrast its structure and strength to their original electromagnet.
3. Have students compare and contrast traditional MRI with fMRI: how they work, what they are used for, etc.

Differentiation in science can be accomplished in several ways. Once you have given a pre-test to students, you know what information has already been mastered and what they still need to work on. Next, you design activities, discussions, lectures, and so on to teach information to students. The best way is to have two or three groups of students divided by ability level.

While you are instructing one group, the other groups are working on activities to further their knowledge of the concepts. For example, while you are helping one group learn the planet names in order, another group is researching climate, size, and distance from the moon of each planet. Then the groups switch, and you instruct the second group on another objective from the space unit. The first group practices writing the order of the planets and drawing a diagram of them.

Here are some ideas for the classroom when you are using differentiation in science:

- Create a tic-tac-toe board that lists different activities at different ability levels. When students aren't involved in direct instruction with you, they can work on activities from their tic-tac-toe board. These boards have nine squares, like a tic-tac-toe board; and each square lists an activity that corresponds with the science unit. For example, one solar system activity for advanced science students might be to create a power point presentation about eclipses. For beginning students, an activity might be to make a poster for one of the planets and include important data such as size, order from the sun, whether it has moons, and so on.

- Find websites on the current science unit that students can explore on their own.

- Allow students to work in small groups to create a project throughout the entire unit. For example, one group might create a solar system model to scale. Another group might write a play about the solar system. This is an activity these groups can work on while they are not working directly with you.

Differentiation in science gets students excited to learn because it challenges them to expand their knowledge and skills, instead of teaching the whole group concepts they have already mastered.

Modifications & Accommodations

Refer to QSAC EXCEL SMALL SPED ACCOMMOCATIONS spreadsheet in this discipline.

Modifications and Accommodations used in this unit:

In addition to differentiated instruction, IEP's and 504 accommocations will be utilized.

Benchmark Assessments

Benchmark Assessments are given periodically (e.g., at the end of every quarter or as frequently as once per month) throughout a school year to establish baseline achievement data and measure progress toward a standard or set of academic standards and goals.

Schoolwide Benchmark assessments:

Aimsweb benchmarks 3X a year

Linkit Benchmarks 3X a year

Additional Benchmarks used in this unit:

Benchmark Assessments given December and June.

The students will complete an online summative assessment that assesses their knowledge of concepts taught between January and May. It is a multiple choice test made in Google Forms and administered through Google Classroom.

Formative Assessments

Assessment allows both instructor and student to monitor progress towards achieving learning objectives, and can be approached in a variety of ways. **Formative assessment** refers to tools that identify misconceptions, struggles, and learning gaps along the way and assess how to close those gaps. It includes effective tools for helping to shape learning, and can even bolster students' abilities to take ownership of their learning when they understand that the goal is to improve learning, not apply final marks (Trumbull and Lash, 2013). It can include students assessing themselves, peers, or even the instructor, through writing, quizzes, conversation, and more. In short, formative assessment occurs throughout a class or course, and seeks to improve student achievement of learning objectives through approaches that can support specific student needs (Theal and Franklin, 2010, p. 151).

Formative Assessments used in this unit:

See assessments located in the unit link above

Also, teacher-made assessments administered via Google Classroom and Forms

Summative Assessments

Summative assessments evaluate student learning, knowledge, proficiency, or success at the conclusion of an instructional period, like a unit, course, or program. Summative assessments are almost always formally graded and often heavily weighted (though they do not need to be). Summative assessment can be used to

great effect in conjunction and alignment with formative assessment, and instructors can consider a variety of ways to combine these approaches.

Summative assessments for this unit:

See assessments located in the unit link above

Also, teacher-made assessments administered via Google Classroom and Forms

Instructional Materials

See materials located in Unit above.

Discovery Techbook

Teacher made materials

Additonal labs available through online resources

Wires, batteries, bulbs, switches and various electrical materials

Standards

SCI.MS.PS2.B	Types of Interactions
SCI.MS-PS2	Motion and Stability: Forces and Interactions
SCI.MS-PS3-2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
SCI.MS-PS2-3	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
SCI.MS-PS3	Energy
	Assessment is limited to electric and magnetic fields and limited to qualitative evidence for the existence of fields.
	Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively).
	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.
	Assessment is limited to two objects and electric, magnetic, and gravitational interactions.

Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.