3rd Grade Unit 2: Electrical and Magnetic Forces

Content Area: **Science**
Course(s): **Science Grade 3**
Time Period: **MP1**
Length: **10 days**
Status: **Published**

NJSLS - Science

SCI.3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
SCI.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.
SCI.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.
SCI.3-PS2-4	Define a simple design problem that can be solved by applying scientific ideas about magnets.

Science and Engineering Practices

Asking Questions and Defining Problems

Ask questions that can be investigated based on patterns such as cause and effect relationships. (3-PS2-3)

Define a simple problem that can be solved through the development of a new or improved object or tool. (3-PS2-4)

Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)

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)

Disciplinary Core Ideas

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 depends 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)

ETS1.A: Defining and Delimiting Engineering Problems

Possible solutions to a problem are limited by the available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1)

ETS1.B: Developing Possible Solutions

Research on a problem, such as climate change, 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)

Crosscutting Concepts

Cause and Effect

Cause and effect relationships are routinely identified, tested, and used to explain change. (3-PS2-3)

Influence of Science, Engineering, and Technology on Society and the Natural World

People’s needs and wants change over time, as do their demands for new and improved technologies. (3-5-ETS1-1)

Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands. (3-5-ETS1-2)

Interdependence of Science, Engineering, and Technology

Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process. (3-PS2-4)

Rationale and Transfer Goals

How can we use our understanding about magnets to solve problems?

In this unit of study, students determine the effects of balanced and unbalanced forces on the motion of an object and the cause-and-effect relationships of electrical or magnetic interactions to define a simple design problem that can be solved with magnets. The crosscutting concept of cause and effect, and the interdependence of science, engineering, and technology, and the influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in asking questions and defining problems. Students are also expected to use these practices to demonstrate an understanding of the core ideas.

Enduring Understandings

There are similarities among both magnetic objects and nonmagnetic objects.

There are balanced and unbalanced forces.

Essential Questions

What are the relationships between electrical and magnetic forces?

How can we use our understanding about magnets to solve problems?

Content - What will students know?

- Cause-and-effect relationships are routinely identified, tested, and used to explain change.
- 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.
- Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process.
- People's needs and wants change over time, as do their demands for new and improved technologies.
- Possible solutions to a problem are limited by available materials and resources (constraints).
- The success of a designed solution is determined by considering the desired features of a solution (criteria).

Skills - What will students be able to do?

- Identify cause-and-effect relationships that are routinely identified, tested, and used to explain change.
- Ask questions that can be investigated based on patterns such as cause-and effect relationships.
- Ask questions to determine cause-and-effect relationships in electric or magnetic interactions between two objects not in contact with each other.
- Define a simple problem that can be solved through the development of a new or improved object or tool.
- Define a simple design problem that can be solved by applying scientific ideas about magnets (e.g., constructing a latch to keep a door shut or creating a device to keep two moving objects from touching each other).
- Define a simple design problem that can be solved through the development of an object, tool, process, or system, and include several criteria for success and constraints on material, time, or cost.
- Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- Describe electric and magnetic forces between a pair of objects when they are/are not in contact.
- Create situations to understand the sizes of the forces depending on the properties of the objects and their distances apart.
- Identify the needs for new technologies and solutions based on changing needs of people.

Activities - How will we teach the content and skills?

- Mystery Science Invisible Forces Lesson 4
- Mystery Science Invisible Forces Lesson 5
- Whole group instruction and discussion.
- Read Alouds
- Group and Individual Projects
- Hands-on discovery when possible; creating models
- Webquests/Internet “field trips”

Evidence/Assessments - How will we know what students have learned?

- Mystery Science Invisible Forces Lesson 4 Assessment
- Mystery Science Invisible Forces Lesson 5 Assessment
- Mystery Science Invisible Forces Performance Task
- Teacher Observation
- Student projects/models
- Exit Tickets
- Tests/Quizzes
- Grade 3 Science Benchmark #1 (taken after Unit 2)

Spiraling for Mastery

Content or Skill for this Unit	Spiral Focus from Previous Unit	Instructional Activity
• Electric and magnetic forces between a pair of objects do not require that the objects be in contact.	Kindergarten: Pushes and pulls can have different strengths and directions.	K-PS2-1 Activities K-PS2-2 Activities

• 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.	Kindergarten: Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. Kindergarten: When objects touch or collide, they push on one another and can change motion. Kindergarten: A bigger push or pull makes things speed up or slow down more quickly. Kindergarten: A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. Grade 1: Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.	1-ESS1-1 Activities

Key Resources

Mystery Science

Investigate the Magnetic Force Field

21st Century Life and Careers

WRK.9.2.5.CAP.3	Identify qualifications needed to pursue traditional and non-traditional careers and occupations.
WRK.9.2.5.CAP.4	Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements.

Career Readiness, Life Literacies, & Key Skills

TECH.9.4.5.CI.1	Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).
TECH.9.4.5.CI.2	Investigate a persistent local or global issue, such as climate change, and collaborate with individuals with diverse perspectives to improve upon current actions designed to address the issue (e.g., 6.3.5.CivicsPD.3, W.5.7).
TECH.9.4.5.IML.3	Represent the same data in multiple visual formats in order to tell a story about the data.

Interdisciplinary Connections/Companion Standards

NJSLS ELA

RI.3.1 Ask and answer questions, and make relevant connections to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-PS2-3)

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)

RI.3.8 Describe the logical connection between particular sentences and paragraphs in a text (e.g., comparison, cause/effect, first/second/third in a sequence) to support specific points the author makes in a text. (3-PS2-3)

SL.3.3 Ask and answer questions about information from a speaker, offering appropriate elaboration and detail. (3-PS2-3)

W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-1)

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work and provide a list of sources. (3-5-ETS1-1)

W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (3-5-ETS1-1)

NJSLS Mathematics

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

MP.4 Model with mathematics. (3-5-ETS1-1)

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

3-5.OA Operations and Algebraic Thinking (3-5-ETS1-1)

English Language Arts

Students should be given opportunities to conduct short research projects that build knowledge about electric and magnetic forces. They should be given multiple opportunities to recall and gather information from their investigations as well as from print and digital sources. Students should use that information to answer questions, describe cause-and-effect relationships, make comparisons, and explain interactions between objects when electrical or magnetic forces are involved. Teachers should provide a variety of texts for students to explore in order to develop students' note-taking skills. As students take notes, they should use graphic organizers, such as Venn diagrams and T-charts, to sort supporting

evidence into provided categories. For example, as students read a variety of texts about forces, they can take notes and then sort the evidence they collect into categories, such as electrical and magnetic forces.

Mathematics

Students should use measurement tools in a variety of ways as they conduct investigations. They could find the mass of an object in order to understand that the more mass an object has, the greater the force needed to attract, repel, or move it. Students then reason mathematically as they analyze their data to determine patterns of change that can be used to support explanations of cause-and-effect relationships. Students might also use algebraic reasoning during investigations. For example, when measuring magnetic strength by increasing the number of magnets, students can use multiplication to make predictions about possible outcomes. So, if a paper clip moves toward a single magnet when it is 2 centimeters away, then students might predict that the paper clip will move toward a double magnet when it is 4 centimeters away. Or, if the paper clip moved towards a set of four magnets at a distance of 8 centimeters, then students might predict that the paper clip will move toward a single magnet when it is 2 centimeters away.