# Unit 2: Electricity and Magnetism

Content Area: **Science**
Course(s): **Science**
Time Period: **Marking Period 2**
Length: **8-10 Weeks**
Status: **Published**

## Unit Overview

The goal of this unit is for students to explore the question of why some objects are attracted to each other and others are not. Students also apply ideas about electrical and magnetic forces to explain a variety of phenomena including beginning ideas about why some materials attract each other while others repel. Students will develop the understanding that gravitational interactions are always attractive but that electrical and magnetic forces can be both attractive and negative. Students also develop ideas that objects can exert forces on each other, even though the objects are not in contact, through fields.

## Performance Expectations

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| SCI.MS-PS2-5 | Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. |
| SCI.MS-PS2-3 | Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. |

## Three Dimensions

## Science and Engineering Practices

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| SEP.1 | Asking Questions and Defining Problems |
| SEP.2 | Developing and Using Models |
| SEP.3 | Planning and Carrying Out Investigations |
| SEP.4 | Analyzing and Interpreting Data |
| SEP.5 | Using Mathematics and Computational Thinking |
| SEP.6 | Constructing Explanations and Designing Solutions |
| SEP.7 | Engaging in Argument from Evidence |
| SEP.8 | Obtaining, Evaluating, and Communicating Information |

## Disciplinary Core Ideas

# MS.Forces and 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)

- 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). (MS-PS5)

## Crosscutting Concepts

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| CCC.1 | Patterns. |
| CCC.2 | Cause and effect: Mechanism and explanation. |
| CCC.3 | Scale, proportion, and quantity. |
| CCC.4 | Systems and system models. |
| CCC.5 | Energy and matter: Flows, cycles, and conservation. |
| CCC.6 | Structure and function. |
| CCC.7 | Stability and change. |

## Knowledge, Skills, and Assessment

| Essential Insights and Understandings/Guiding Questions | Critical Knowledge and Skills | Act |
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| What is magnetism? | Magnets attract iron and similar materials that contain iron. They attract and repel other magnets. One part of the magnet will point North when allowed to swing freely. | **Activity** and non-determin |
| How do magnets interact through invisible forces? | **Skill: SWBAT...**<br>• **Differentiate between ferromagnetic materials and other materials by testing for attraction/repulsion and the ability to point North when suspended freely.** | **Activity** magnets filings o lines for |
| How does distance between magnetics influence strength of the magnetic field? | Magnetic poles that are unlike attract each other and magnetic poles that are alike repel each other. Magnetic field lines spread out from one pole, curve around the magnet, and return to the other pole. | **Assessm** magnets model o would in |

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| | **Skill: SWBAT...**<br>• **Model magnetic field lines by drawing how the field connects from pole to pole.**<br>• **Model interactions of like and unlike pole's magnetic field lines (show attraction or repulsion).**<br>• **Model how the magnetic field lines change as the magnets move further and closer.** | |
| What is electricity?<br><br>How does charge build on an object? | Charges that are the same repel each other. Charges that are different attract each other. An electric field is a region around an object where the object's electric force interacts with other charged forces.<br><br>**Skill: SWBAT...**<br>• **Predict if charges are the same or different on objects based on their attraction or repulsion.**<br><br>Static electricity charge builds up on an object but does not continuously flow. Static electricity can be built through friction, conduction, and induction. When negatively and positively charged objects are brought together, electrons transfer until both objects have the same charge.<br><br>**Skill: SWBAT**<br>• **Demonstrate the effects of static electricity by generating it through friction, conduction, and induction using materials of their choice best suited for the demonstration.**<br>• **Model the transfer of negative charge (electrons) on an atomic level when objects undergo friction, conduction, or induction.** | **Activity**<br>create sta<br>balloons.<br>electricit<br>how to c<br><br>**Activity**<br>static ele<br>level. Di<br>and write<br>of the ele<br><br>**Assessm**<br>demonst<br>in a stati<br>phenome |

## Suggested Resources

CK12 Resources for Magnetism:

- http://www.ck12.org/physics/Magnets/
- http://www.ck12.org/earth-science/Earths-Magnetic-Field/lesson/Earths-Magnetic-Field-MS-ES/
- http://www.ck12.org/physical-science/Using-Earths-Magnetic-Field-in-Physical-Science/lesson/Using-Earths-Magnetic-Field-MS-PS/
- http://www.ck12.org/physics/Magnets/asmtpractice/Magnets-Practice/

CK12 Resources for Electricity:

- http://www.ck12.org/physical-science/Static-Electricity-and-Static-Discharge-in-Physical-Science/lesson/Static-Electricity-and-Static-Discharge-MS-PS/
- http://www.ck12.org/physics/Series-Circuits/
- http://www.ck12.org/physics/Generators-and-Motors/

## Technology Integration

Online video from D News, CrashCourse, CrashCourse Kids, Brain Pop.

iPads

Chromebooks

CK12 Flexbook

PHeT simulator

## Differentiation

**Differentiation for special education:**

- General modifications may include:
  - Modifications & accommodations as listed in the student's IEP
  - Assign a peer to help keep student on task
  - Modified or reduced assignments
  - Reduce length of assignment for different mode of delivery
  - Increase one-to-one time
  - Working contract between you and student at risk
  - Prioritize tasks
  - Think in concrete terms and provide hands-on-tasks
  - Position student near helping peer or have quick access to teacher
  - Anticipate where needs will be
  - Break tests down in smaller increments
- Content specific modifications may include:
  - Provide hands-on demonstrations of magnetic materials.
  - Use iron filings to create real-life magnetic field lines to aid student understanding of fields.
  - Use online or hands-on models of magnetic fields to aid student understanding.

**Differentiation for ELL's:**

- General modifications may include:
  - Strategy groups

    - Teacher conferences
    - Graphic organizers
    - Modification plan
    - Collaboration with ELL Teacher
- Content specific vocabulary important for ELL students to understand include: magnetism, magnetic field, magnetosphere, charge, static electricity, discharge, current, conductor, insulator, resistance, circuit, friction, conduction, induction.

**Differentiation to extend learning for gifted students may include:**

7th Grade Science Blog: Choose a physical science based D!News, CrashCourse, or Crash Course Kids topic to view on YouTube or find an article in Popular Science. Write a breif response to the article or video and post it on the collaborative 7th Grade class blog.

Exploration Topics:

- Can materials become magnetic? Choose metals from the materials draw. See if an existing magnet can cause that metal to become magnetic.
- Magnetic Earth: Read C12 Article: Magnetic Earth or text pages 22-25 and complete the data analysis sheet about about Earth's moving magnetic field.
- Create a Versorium: Use a cup, pencil, and piece of foil to create a versorium. (Look up images to construct). Induct static electricity and note what happens. Use knowledge of magnetic and electric fields to explain why it spins.
- Circuit Engineering: Look up the term parallel circuit. Use circuit kits to build a working parallel circuit. Explain why parallel circuits are useful in construction and engineering.
- Battery Construction: Research Galvani and Volta's first batteries. Imagine yourself in a place or world with limited technology and resources. Write a step by step guide on how to build one of these simple batteries.

## 21st Century Skills

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| CRP.K-12.CRP1.1 | Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good. |
| CRP.K-12.CRP2.1 | Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation. |
| CRP.K-12.CRP4.1 | Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are |

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| | excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome. |
| CRP.K-12.CRP7.1 | Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation. |
| CRP.K-12.CRP11.1 | Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks. |
| CRP.K-12.CRP12.1 | Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings. |