Unit 12: Magnetism

Content Area: **Template**
Course(s):
Time Period:
Length:
Status: **Published**

State Mandated Topics Addressed in this Unit

This unit aligns with the following NJ Student Learning Standards for Science (NJSLS-S) and supports students' exploration of how electricity and magnetism are fundamentally linked:

NJSLS-S Performance Expectations:

- **HS-PS2-5**: Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.
- **HS-PS3-5**: Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

Integrated Mathematics Standards (NJSLS-M):

- **A-CED.A.1**: Create equations and inequalities in one variable and use them to solve problems.
- **F-IF.C.7**: Graph functions expressed symbolically and show key features of the graph.

Science & Engineering Practices (SEPs):

- 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

Crosscutting Concepts:

- Cause and Effect
- Systems and System Models
- Energy and Matter
- Structure and Function

These standards support instructional objectives including:

- Investigating the magnetic field generated by electric currents

- Modeling electromagnetic induction
- Exploring the relationship between electric motors and generators
- Applying energy transfer and field concepts to technological systems

Unit Summary

This unit explores the formation, behavior, and applications of magnetic fields, and their fundamental connection to electricity. Students will investigate how moving electric charges create magnetic fields and how changing magnetic fields can induce electric currents, highlighting the principle of electromagnetism. They will model interactions between magnetic fields and electric currents, analyze real-world examples such as electric motors and generators, and apply their knowledge in inquiry-based lab activities. The unit emphasizes energy transformations, force interactions, and field models, all aligned with the NJ Student Learning Standards for high school physical science.

Learning Objectives

- How can we model magnetic field strength and direction?
- How do magnetic fields exert forces on moving charges and current-carrying wires?
- How does a changing magnetic field create an electric current?
- How does an electric current produce a magnetic field?
- How does Earth's magnetic field protect life on the planet?
- How many times can a magnet be cut in half and still be magnetic?
- What causes earth's magnetic field?
- What real-world technologies rely on the relationship between electricity and magnetism?

Essential Skills

- Analyze real-world technologies (e.g., MRIs, speakers, maglev trains) that rely on magnetism.
- Compare magnetic field strength at different distances from a magnet or wire.
- Describe how a motor works.
- Describe how transformers use electromagnetic induction to transfer electrical energy.
- Describe the magnetic field in the space around a magnet.
- Describe the magnetic field produced by a current-carrying wire.
- Design and analyze simple experiments demonstrating electromagnetic induction.

- Differentiate between temporary and permanent magnets based on atomic structure.
- Explain how magnetic fields exert forces on moving charges and current-carrying wires.
- Explain how magnetic poles affect each other.
- Identify the parts and function of electric motors and generators.
- Model the relationship between electric currents and magnetic fields using diagrams or simulations.

Standards

SCI.HS-PS2-5	Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.
SCI.HS-PS3-5	Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.
9-12.HS-PS2-4	Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

Instructional Tasks/Activities

- Constructed response
- Common assessment chapter test
- Common assessment quiz
- Do now's and/or exit slips
- Exit Cards (answer to daily objective questions)
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- Graphic organizers or models
- Guided practice
- Homework
- Homework
- Individual, small, and large group work
- Laboratory investigations within small groups
- Review Activity
- Section Review Questions
- Vocabulary flash cards or map (word, picture, sentence, example)

Assessment Procedure

- Flashcards and/or drill and practice
- Inquiry based activities with reflective discussion
- Laboratory groups
- Lecture with note taking or guided notes

- Online models and simulators
- Power point presentations
- Whole and small group discussions

Recommended Technology Activities

- Appropriate Content Specific Online Resource
- Chromebook
- Copy/Paste Content Specific Link Here
- Copy/Paste Content Specific Link Here
- Copy/Paste Content Specific Link Here
- Gimkit
- GoGuardian
- Google Classroom
- Google Docs
- Google Forms
- Google Slides
- Kahoot
- MagicSchool AI
- Other- Specified in Lesson
- Quiziz
- Screencastify

Accommodations & Modifications & Differentiation

Accommodations and Modifications should be used to meet individual needs. Their IEP and 504 plans should be used in addition to the following suggestions.

Gifted and Talented

- Compare & Contrast
- Conferencing
- Debates
- Jigsaw
- Peer Partner Learning
- Problem Solving
- Structured Controversy
- Think, Pair, Share

- Tutorial Groups

Instruction/Materials

- alter format of materials (type/highlight, etc.)
- color code materials
- eliminate answers
- extended time
- extended time
- large print
- modified quiz
- modified test
- Modify Assignments as Needed
- Modify/Repeat/Model directions
- necessary assignments only
- Other (specify in plans)
- other- named in lesson
- provide assistance and cues for transitions
- provide daily assignment list
- read class materials orally
- reduce work load
- shorten assignments
- study guide/outline
- utilize multi-sensory modes to reinforce instruction

Environment

- alter physical room environment
- assign peer tutors/work buddies/note takers
- assign preferential seating
- individualized instruction/small group
- modify student schedule (Describe)
- other- please specify in plans
- provide desktop list/formula

Honors Modifications

Resources

- Resource 1
- Resource 2
- Resource 3
- Resource 4
- Resource 5