

Winslow Township School District
Laboratory Physics
Unit 5 Electricity and Magnetism

Overview In this unit of study, students’ understanding of how forces at a distance can be explained by fields, why some materials are attracted to each other while other are not, how magnets or electric currents cause magnetic fields, and how charges or changing magnetic fields cause electric fields. The crosscutting concept of *cause and effect* is called out as an organizing concept. Students are expected to demonstrate proficiency *in planning and conducting investigations and developing and using models*.

Overview	Standards for Science	Unit Focus	Essential Questions
<p>Unit 5</p> <p>Electricity and Magnetism</p>	<p>HS-PS2-5 HS-PS3-5 • WIDA 1,4</p>	<ul style="list-style-type: none"> • 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. • 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. 	<p><i>How can one explain and predict the interactions between objects and within a system of objects?</i></p> <p><i>What are the relationships between electric currents and magnetic fields?</i></p>
<p><i>Unit 5: Enduring Understandings</i></p>	<ul style="list-style-type: none"> • Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. • Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. • “Electrical energy” may mean energy stored in a battery or energy transmitted by electric currents. <p>Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. When two objects interacting through a field change relative position, the energy stored in the field is changed.</p> <p>Cause-and-effect relationships between electrical and magnetic fields can be predicted through an understanding of inter- and intra-molecular forces (protons and electrons).</p>		

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Curriculum Unit 5	Standards		Pacing	
			Days	Unit Days
Unit 5: Electricity and Magnetism	HS-ETS1-2	<ul style="list-style-type: none"> Students will learn about interference and diffraction. They will learn that in interference, light waves combine to produce resultant waves that are either brighter or less bright than the component waves. 	20	50
	HS-ETS1-3			
	PS3.A PS3.B HS-PS3-2 HS-PS3-1 HS-PS3-3 HS-PS4-1 HS-PS4-3	<ul style="list-style-type: none"> Students will learn about the basic properties of electric charges. They will learn to calculate the electric force produced by point charges and will learn to interpret electric field lines. Students will learn about electric potential energy and about how capacitors can be used to store electric energy. They will be introduced to electric current and resistance. 	15	
	PS3.A PS3.B HS-PS3-2 HS-PS3-1 HS-PS3-3 HS-ETS1-1 HS-PS4-4 HS-PS4-5	<ul style="list-style-type: none"> Students will learn that a current carrying coil of wire behaves like a magnet. They will also study the forces exerted on charged particles that are moving in a magnetic field. 	12	
	Assessment, Re-teach and Extension		3	

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Disciplinary Core Ideas	Indicator #	Indicator
<p>PS2.B: Types of Interactions</p> <ul style="list-style-type: none"> Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. (HS-PS2-5) PS3.C: Relationship between Energy and Forces When two objects interacting through a field change relative position, the energy stored in the field is changed. (HS-PS3-5) 	HS-PS2-5	Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
	HS-PS3-5	Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.

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• **Assessment Plan**

<ul style="list-style-type: none"> • Exploratory activities • Warm-up activities • Individual/Group Lab report • Class discussions • Student Participation • Teacher Observations 	<ul style="list-style-type: none"> • Quizzes • Tests • Authentic assessments and projects • Exploratory activities • Presentations
Resources	Activities
<ul style="list-style-type: none"> • Chromebooks • Textbook • Reading Essentials Workbook • Web Quests • Virtual Field Trips • Video Streaming • BrainPOP • Puzzlemaker: Game Based Learning Discovery Education • Solar System Revolution Webquest: https://njctl.org/courses/archived-courses-units/6thgrade-science/earth-and-the-solar-system/attachments/solar-system-revolution-webquest/ • Eclipse Activity: https://njctl.org/courses/archived-courses-units/6thgrade-science/earth-and-the-solar-system/attachments/eclipse-activity/ <p>Diversity, Equity & Inclusion Educational Resources https://www.nj.gov/education/standards/dei/</p>	<ul style="list-style-type: none"> • Use physical models to examine the phases of the moon using a light source and a moon model to view the various shapes of the moon as it orbits the earth and keep a lunar calendar for one month and analyze the results by looking for differences and patterns. • Measure the acceleration of the objects as they fall from various heights and determine that the objects speed up as they fall, therefore proving that a force is acting on them. • mini-lessons • independent reading • films • website exploration • discussions, dialogues • debates • partner or small group work • student presentations, reports, journals, reflections, • in-class assessments, • written reports, essays, research, and homework

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Instructional Best Practices and Exemplars

1. Identifying similarities and differences
2. Summarizing and note taking
3. Reinforcing effort and providing recognition
4. Homework and practice
5. Nonlinguistic representations

6. Cooperative learning
7. Setting objectives and providing feedback
8. Generating and testing hypotheses
9. Cues, questions, and advance organizers
10. Manage response rates

9.1 Personal Financial Literacy, 9.2 Career Awareness, Exploration, Preparation and Training & 9.4 Life Literacies and Key Skills

- 9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs
- 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.
- 9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans.
- 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions.
- 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience.

The implementation of the 21st Century skills and standards for students of the Winslow Township District is infused in an interdisciplinary format in a variety of curriculum areas that include, English language Arts, Mathematics, School Guidance, Social Studies, Technology, Visual and Performing Arts, Science, Physical Education and Health, and World Language.

Additional opportunities to address 9.1, 9.2 & 9.4:

Philadelphia Mint

<https://www.usmint.gov/learn/kids/resources/educational-standards>

Different ways to teach Financial Literacy.

<https://www.makeuseof.com/tag/10-interactive-financial-websites-teach-kids-money-management-skills/>

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Modifications for Special Education/504

Students with special needs: The students' needs will be addressed on an individual and grade level using a variety of modalities. Accommodations will be made for those students who need extra time to complete assignment. Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

- Small group instruction
- Audio books/ Text-to-speech platforms
- Leveled texts/Vocabulary Readers
- Leveled informational texts via online
- Modeling and guided practice
- Read directions aloud
- Repeat, rephrase and clarify directions
- Extended time as needed
- Break down assignments into smaller units
- Provide shortened assignments
- Modify testing format
- Repeat directions as needed
- Graphic organizers
- Study Guides, Study Aids and Re teaching as needed

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Modifications for At-Risk Students

Formative and summative data will be used to monitor student success. At first signs of failure, student work will be reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations

- Audio books and Text-to-speech platforms
- Leveled texts/Vocabulary Readers
- Leveled informational texts via online
- Extended time as needed
- Read directions aloud
- Assist with organization
- Use of computer
- Emphasize/highlight key concepts
- Recognize success
- Provide timelines for work completion
- Break down multi-step tasks into smaller chunks
- Provide copy of class notes and graphic organizer

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English Language Learners	Modifications for Gifted Students
<p>All WIDA Can Do Descriptors can be found at this link: https://wida.wisc.edu/teach/can-do/descriptors</p> <p><input type="checkbox"/> Grades 9-12 WIDA Can Do Descriptors:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Listening <input type="checkbox"/> Speaking <input type="checkbox"/> Reading <input type="checkbox"/> Writing <input type="checkbox"/> Oral Language <p>Students will be provided with accommodations and modifications that may include:</p> <ul style="list-style-type: none"> • Relate to and identify commonalities in science studies in student’s home country • Assist with organization • Use of computer • Emphasize/highlight key concepts • Teacher Modeling • Peer Modeling • Label Classroom Materials - Word Walls 	<p>Students excelling in mastery of standards will be challenged with complex, high level challenges related to the topic.</p> <ul style="list-style-type: none"> • Raise levels of intellectual demands • Require higher order thinking, communication, and leadership skills • Differentiate content, process, or product according to student’s readiness, interests, and/or learning styles • Provide higher level texts • Expand use of open-ended, abstract questions • Critical and creative thinking activities that provide an emphasis on research and in-depth study • Enrichment Activities/Project-Based Learning/ Independent Study <p>Additional Strategies may be located at the links:</p> <ul style="list-style-type: none"> ❖ Gifted Programming Standards ❖ Webb’s Depth of Knowledge Levels and/or Revised Bloom’s Taxonomy ❖ REVISED Bloom’s Taxonomy Action Verbs

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Interdisciplinary Connections

- ELA:**
- RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts.
 - 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).
 - SL.8.5** Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

- Math:**
- MP.2** Reason abstractly and quantitatively.
 - MP.4** Model with mathematics.
 - 6.RP.A.1** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
 - 7.RP.A.2** Recognize and represent proportional relationships between quantities.
 - 6.EE.B.6** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.
 - 7.EE.B.6** Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.
their context.

Integration of Computer Science and Design Thinking NJSL 8

- 8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
- 8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment.
- 8.2.12.EC.3: Synthesize data, analyze trends, and draw conclusions regarding the effect of a technology on the individual, culture, society, and environment and share this information with the appropriate audience.