

Winslow Township School District
Laboratory Physics
Unit 2 Fundamental Forces

Overview: In this unit of study, students plan and conduct investigations and apply scientific ideas to make sense of Newton’s law of gravitation and Coulomb’s Law. They apply these laws to describe and predict the gravitational and electrostatic forces between objects. The crosscutting concept of *patterns* is called out as an organizing concept for this disciplinary core idea. Students are expected to demonstrate proficiency in *planning and conducting investigations* and *applying scientific ideas* to demonstrate an understanding of core ideas.

Overview	Standards for Science	Unit Focus	Essential Questions
Unit 2 Fundamental Forces	<ul style="list-style-type: none"> • PS2.B • HS-PS2-4 • WIDA 1,4 	<ul style="list-style-type: none"> • Make predictions about the sign and relative quantity of net charge of objects or systems after various charging processes. • Construct an explanation of a model of electric charge, and make a qualitative prediction about the distribution of positive and negative electric charges within neutral systems as they undergo various processes. • Use mathematical representations of Newton’s Law of Gravitation and Coulomb’s Law to describe and predict the gravitational and electrostatic forces between objects. 	<p style="text-align: center;"><i>How can one explain and predict interactions between objects and within systems of objects?</i></p>

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*Unit 2:
Enduring
Understandings*

- Newton’s Law of Universal Gravitation provides the mathematical models to describe and predict the effects of gravitational forces between distant objects.
- Forces at a distance are explained by fields (gravitational) permeating space that can transfer energy through space.

Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of the gravitational force between objects.

- Coulomb’s Law provides the mathematical models to describe and predict the effects of electrostatic forces between distant objects.
- Forces at a distance are explained by fields (electric and magnetic) that permeate space and can transfer energy through space.
- Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields.

Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of electrostatic attraction and repulsion.

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Curriculum Unit 2	Standards		Pacing	
			Days	Unit Days
Unit 2: Fundamental Forces	HS-PS2-1 HS-PS2-2 HS-PS2-3 HS-ETS1-2 HS-ETS1-3	<p>Forces and the Laws of Motion Students will learn to analyze interactions by identifying the forces involved. They will be able to predict and understand many types of motion.</p> <ul style="list-style-type: none"> • 	15	35
	HS-PS2-4 HS-ESS1-4	<ul style="list-style-type: none"> • Students will examine the relationship between rotational motion and circular motion. They will consider the concepts of tangential speed and acceleration and the force that maintains circular motion. 	8	
	PS3.A PS3.B HS-PS3-2 HS-PS3-1 HS-PS3-3 HS-ETS1-1	Students will learn how to describe the forces associated with circular motion, including torque and simple machines. They will also investigate the rotational dynamics of various objects and the associated angular momentum and rotational energy.	9	
	Assessment, Re-teach and Extension		3	

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Unit 2		
Disciplinary Core Ideas	Indicator #	Indicator
<p>PS2.B: Types of Interactions</p> <ul style="list-style-type: none"> • Newton’s law of universal gravitation and Coulomb’s law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects.) • 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-PS2-4	<p>Mathematical and computational thinking at the 9–12 level builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.</p> <p>Use mathematical representations of phenomena to describe explanations. (HS-PS2-4)</p>
	HS-PS3-1	<p>Create a computational model or simulation of a phenomenon, designed device, process, or system.</p>

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Unit 2

• 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.