Winslow Township School District
Laboratory Physics
Unit 1 Forces and Motion

Overview: In this unit of study, students are expected to *plan and conduct investigations*, *analyze data and using math to support claims*, and *apply scientific ideas to solve design problems* students in order to develop an understanding of ideas related to why some objects keep moving and some objects fall to the ground. Students will also build an understanding of forces and Newton's second law. Finally, they will develop an understanding that the total momentum of a system of objects is conserved when there is no net force on the system. Students are also able to apply science and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. The crosscutting concepts of *patterns*, *cause and effect*, and *systems and systems models* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate proficiency in *planning and conducting investigations*, *analyzing data and using math to support claims*, and *applying scientific ideas to solve design problems* and to use these practices to demonstrate understanding of the core ideas.

Overview	Standards for Science	Unit Focus	Essential Questions
Unit 1 **Forces and Motion**	• **HS-PS2-1** • **HS-PS2-2** • **HS-PS2-3** • **HS-ETS1-2** • **HS-ETS1-3**	• Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. • Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. • Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. • Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. • Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.	***How can one explain and predict interactions between objects and within systems of objects?***

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Unit 1: Enduring Understandings	• Theories and laws provide explanations in science. • Laws are statements or descriptions of the relationships among observable phenomena. • Empirical evidence is required to differentiate between cause and correlation and to make claims about specific causes and effects. Newton's second law accurately predicts changes in the motion of macroscopic objects. • Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object. • If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. • When investigating or describing a system, the boundaries and initial conditions of the system need to be If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. • Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and the criteria and constraints should be quantified to the extent possible and stated in such a way that one can determine whether a given design meets them. • Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed.	

	• When evaluating solutions, it is important to take into account a range of constraints— including cost, safety, reliability, and aesthetics—and to consider social, cultural, and environmental impacts. • New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. Systems can be designed to cause a desired effect. defined.	

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Curriculum Unit 1	Standards		Pacing	
			Days	Unit Days
Unit 1: **Forces and Motion**	**HS-PS2-1** **HS-PS2-2** **HS-PS2-3** **HS-ETS1-2** **HS-ETS1-3**	• Students will learn about the branches of physics, the scientific method and the use of models in physics. Students will also learn some useful tools for working with measurements and data. • Students will learn how to analyze one-dimensional motion in terms of displacement, time, speed, and velocity. Students will also learn how to distinguish between accelerated and nonaccelerated motion.	13	28
	HS-PS2-1 **HS-PS2-2** **HS-PS2-3** **HS-ETS1-2** **HS-ETS1-3**	• Students will use vectors and trigonometric functions to analyze two-dimensional motion and to solve problems in which objects are projected into the air. Students will learn to analyze interactions by identifying the forces involved. They will be able to predict and understand many types of motion.	13	
	Assessment, Re-teach and Extension		2	

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Unit 1		
Disciplinary Core Ideas	**Indicator #**	**Indicator**
PS2.A: Forces and Motion • Newton's second law accurately predicts changes in the motion of macroscopic objects. • Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object.	HS-PS2-1	Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
	HS-PS2-2	. Use mathematical representations of phenomena to describe explanations.

ETS1.A: Defining and Delimiting Engineering Problems • Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. **ETS1.C: Optimizing the Design Solution** • Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed. • If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. **ETS1.B: Developing Possible Solutions** • When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.	**HS-PS2-3** **HS-PS2-2** **HS-ETS1-3**	• Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects. • Design a solution to a complex real world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. • Evaluate a solution to a complex real world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

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Unit 1	
• **Assessment Plan**	
• Exploratory activities • Warm-up activities • Individual/Group Lab report • Class discussions • Student Participation • Teacher Observations	•Quizzes • Tests • Authentic assessments and projects • Exploratory activities • Presentations
Resources	**Activities**
• 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/ Diversity, Equity & Inclusion Educational Resources https://www.nj.gov/education/standards/dei/	• 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

9.1.12.CFR.4: Demonstrate an understanding of the interrelationships among attitudes, assumptions, and patterns of behavior regarding money, saving, investing, and work across cultures.
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.

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
All WIDA Can Do Descriptors can be found at this link: https://wida.wisc.edu/teach/can-do/descriptors ☐ Grades 9-12 WIDA Can Do Descriptors: ☐ Listening ☐ Speaking ☐ Reading ☐ Writing ☐ Oral Language Students will be provided with accommodations and modifications that may include: • 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	Students excelling in mastery of standards will be challenged with complex, high level challenges related to the topic. • 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 Additional Strategies may be located at the links: ❖ 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 NJSLS 8
8.1.12.CS.2: Model interactions between application software, system software, and hardware. 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers. 8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints.