Winslow Township School District
Laboratory Physics
Unit 3 Energy

Overview: In this unit of study, students *develop and use models, plan and carry out investigations, use computational thinking and design solutions* as they make sense of the disciplinary core idea. The disciplinary core idea of *Energy* is broken down into subcore ideas: *definitions of energy*, *conservation of energy* and *energy transfer*, and *the relationship between energy and forces*. Energy is understood as a quantitative property of a system that depends on the motion and interactions of matter, and the total change of energy in any system is equal to the total energy transferred into and out of the system. Students also demonstrate their understanding of engineering principles when they design, build, and refine devices associated with the conversion of energy. The crosscutting concepts of *cause and effect, systems and systems models, energy and matter, and the influence of science, engineering, and technology on society and the natural world* are further developed in the performance expectations. Students are expected to demonstrate proficiency in *developing and using models, planning and carry out investigations, using computational thinking and designing solutions*, and they are expected to use these practices to demonstrate understanding of core ideas.

Overview	Standards for Science	Unit Focus	Essential Questions
Unit 3 Energy	HS-PS3-2 HS-PS3-1 HS-PS3-3 HS-ETS1-1 HS-ETS1-2 HS-ETS1-3 HS-ETS1-4 • WIDA 1,4	• **Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).** • **Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.** • **Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.** • **Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.**	***How is energy transferred and conserved?***

		• **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.** • **Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.**	
Unit 2: Enduring Understandings	• Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. • At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. • These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). • In some cases, the relative position energy can be thought of as stored in fields (which mediate interactions between particles). • Radiation is a phenomenon in which energy stored in fields moves across spaces.		

	Energy cannot be created or destroyed. It only moves between one place and another place, between objects and/or fields, or between systems. • That there is a single quantity called energy is due to the fact that a system's total energy is conserved even as, within the system, energy is continually transferred from one object to another and between its various possible forms. • Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. • Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. • The availability of energy limits what can occur in any system. • Models can be used to predict the behavior of a system, but these predictions have limited precision and reliability due to the assumptions and approximation inherent in models. Science assumes that the universe is a vast single system in which basic laws are consistent.	

Winslow Township School District
Laboratory Physics
Unit 3 Energy

Curriculum Unit 3	Standards		Pacing	
			Days	Unit Days
Unit 3: **Energy**	**HS-PS2-1** **HS-PS2-2** **HS-PS2-3** **HS-ETS1-2** **HS-ETS1-3**	• Students will learn about work and different types of energy that are relevant to mechanics. Kinetic energy, which is associated with motion, and potential energy, which is related to an object's position, are two forms of energy that will be studied. • Students will analyze momentum and collisions between one or more objects. They will consider the mass and velocity of one or more objects and the conservation of momentum and energy. •	15	35
	HS-PS2-4 **HS-ESS1-4**	• 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	

Winslow Township School District
Laboratory Physics
Unit 3 Energy

Unit 3		
Disciplinary Core Ideas	**Indicator #**	**Indicator**
PS3.A: Definitions of Energy • Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms. • At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy. • These relationships are better understood at the microscopic scale, at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space. **PS3.B: Conservation of Energy and Energy Transfer**	HS-PS3-2	Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.
	HS-PS3-1	Create a computational model or simulation of a phenomenon, designed device, process, or system.
	HS-PS3-3	Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interactions between systems. Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

• Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system. • Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. • Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior. • The availability of energy limits what can occur in any system. **PS3.D: Energy in Chemical Processes**		

Winslow Township School District
Laboratory Physics
Unit 3 Energy

Unit 3	
• **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

Winslow Township School District
Laboratory Physics
Unit 3 Energy

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/

Winslow Township School District
Laboratory Physics
Unit 3 Energy

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

Winslow Township School District
Laboratory Physics
Unit 3 Energy

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

Winslow Township School District
Laboratory Physics
Unit 3 Energy

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

Winslow Township School District
Laboratory Physics
Unit 3 Energy

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
8.2.12.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.