

## Winslow Township School District

### Grade 7 Science

#### Unit 4: Energy and Motion

**Overview:** This unit covers three areas of energy and motion. Students will explore Newton’s Laws and how to describe the position and motion of an object. They will also explore how mechanical energy determines an objects motion by investigating the transfer between potential and kinetic energy. Finally, students will investigate other forces by studying magnets and circuits. The performance expectations in physical science blend the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge to explain real world phenomena in the physical, biological, and earth and space sciences.. These include developing and using models, planning and conducting investigations, analyzing and interpreting data, using mathematical and computational thinking, and constructing explanations; and to use these practices to demonstrate understanding of the core ideas. Students are also expected to demonstrate understanding of several of engineering practices.

Overview	Standards for Science	Unit Focus	Essential Questions
<a href="#">Unit 4</a> Energy and Motion	<ul style="list-style-type: none"><li>• MS-PS2-1</li><li>• MS-PS2-2</li><li>• MS-PS2-3</li><li>• MS-PS2-4</li><li>• MS-PS2-5</li><li>• MS-PS3-1</li><li>• MS-PS3-2</li><li>• MS-PS3-5</li><li>• WIDA 1,4</li></ul>	<ul style="list-style-type: none"><li>• Forces and Motion</li><li>• Mechanical Energy</li><li>• Electromagnetic Forces</li></ul>	<ul style="list-style-type: none"><li>• How do units and direction describe position and motion?</li><li>• How does a push or pull affect motion?</li><li>• How does Newton’s third law relate to force pairs and collisions?</li><li>• How do objects interact with noncontact forces?</li></ul>

**Winslow Township School District**

**Grade 7 Science**

**Unit 4: Energy and Motion**

<p><i>Unit 4: Enduring Understandings</i></p>	<ul style="list-style-type: none"><li>• How to describe the position and motion of an object</li><li>• Analyze data including graphs to help construct and present arguments about the changes over time in the motions of objects</li><li>• How force affects motion</li><li>• Changes in motion are caused by net force</li><li>• Explore how the force exerted by one object on a second object is equal in strength and opposite in direction to the forces that the second object exerts on the first</li><li>• Will model systems of objects to explore the attractive nature of gravitational force, the factors that affect it, and how it affects the motion of objects</li><li>• Define kinetic energy and show proportional relationships among kinetic energy, mass, and speed</li><li>• Describe how potential energy of an object is affected by distance from Earth and mass</li><li>• Determine the relationship between energy and force by analyzing conservation of energy</li><li>• Develop and use models to enhance their understanding of magnetic fields</li><li>• What the size of electric forces depends on</li><li>• Using simple circuits show how electric forces cause the movement of electrically charged particles</li><li>• Discover the interaction between electric charges and magnets</li></ul>	<ul style="list-style-type: none"><li>• What factors determine the kinetic energy of an object?</li><li>• What factors determine the potential energy of an object?</li><li>• How are different types of energy used?</li><li>• How do magnetic fields interact?</li><li>• How does a simple circuit function?</li><li>• What is the relationship between electricity and magnetism?</li></ul>
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**Winslow Township School District**  
**Grade 7 Science**  
**Unit 4: Energy and Motion**

<b>Curriculum Unit 4</b>	<b>Standards</b>		<b>Pacing</b>	
			<b>Days</b>	<b>Unit Days</b>
<b>Unit 4:  Energy and Motion</b>	<b>MS-PS2-1</b>	Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects	4	<b>35</b>
	<b>MS-PS2-2</b>	Plan an investigation to provide evidence that the change in an object’s motion depends on the sum of the forces on the object and the mass of the object.	4	
	<b>MS-PS2-3</b>	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces	4	
	<b>MS-PS2-4</b>	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.	4	
	<b>MS-PS2-5</b>	Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.	4	
	<b>MS-PS3-1</b>	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.	4	
	<b>MS-PS3-2</b>	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.	4	
	<b>MS-PS3-5</b>	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object	4	
<b>Assessment, Re-teach and Extension</b>			3	

**Winslow Township School District**

**Grade 7 Science**

**Unit 4: Energy and Motion**

Unit 4 Grade 7

Disciplinary Core Ideas	Indicator #	Indicator
<p><b>PS2.A: Forces and Motion</b> For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction. (MS-PS2-1)</p>	<p><b>MS-PS2-1</b></p>	<p>Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects</p>
<p>The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS-PS2-2)</p>	<p><b>MS-PS2-2</b></p>	<p>Plan an investigation to provide evidence that the change in an object’s motion depends on the sum of the forces on the object and the mass of the object</p>
<p>All positions of objects and the directions of forces and motions must be described an arbitrarily chosen reference frame and arbitrarily chosen units in size. In order to share information with other people, these choices must also be shared. (MS-PS2-2)</p>	<p><b>MS-PS2-3</b></p>	<p>Plan an investigation to provide evidence that the change in an object’s motion depends on the sum of the forces on the object and the mass of the object.</p>
<p><b>PS2.B: Types of Interactions</b> Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass. (MS-PS2-4)</p>	<p><b>MS-PS2-4</b></p>	<p>Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.</p>

Winslow Township School District

Grade 7 Science

Unit 4: Energy and Motion

<p>Electric and magnetic forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3)</p> <p>Forces that act at a distance can be explained by fields that extend through space and can be mapped by their effect on a test object. (MS-PS2-5)</p> <p><b>PS3.A: Definitions of Energy</b> Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. (MS-PS3-1)</p> <p>A system of objects may also contain stored energy, depending on their relative positions. (MS-PS3-2)</p> <p><b>PS3.C: Relationship Between Energy and Forces</b> When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2)</p> <p><b>PS3.B: Conservation of Energy and Energy Transfer</b> When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5)</p>	<p><b>MS-PS2-5</b></p>	<p>Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.</p>
	<p><b>MS-PS3-1</b></p>	<p>Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.</p>
	<p><b>MS-PS3-2</b></p>	<p>Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.</p>
	<p><b>MS-PS3-5</b></p>	<p>Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object</p>

**Winslow Township School District**  
**Grade 7 Science**  
**Unit 4: Energy and Motion**

Unit 4 Grade 7

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

- Chromebooks
- Textbook
- Web Quests
- Virtual Field Trips
- Video Streaming
- [BrainPOP](#)
- Diversity, Equity & Inclusion Educational Resources  
<https://www.nj.gov/education/standards/dei/>

Activities

- **Pedal Power** - <http://teachers.egfi-k12.org/pedal-power/>
- **Straw Rocket Aeronautics** - <http://teachers.egfi-k12.org/straw-rocket-aeronautics>
- **Rube Goldberg Challenge** - <https://www.rubegoldberg.com>
- **Fruit Battery Power** - <http://www.sciencefairadventure.com/ProjectDetail.aspx?ProjectID=154>
- **Roller Coaster Physics** - <http://www.learner.org/interactives/parkphysics/coaster.html>
- **Investigating forces** - <http://scienceonline.tki.org.nz/Nature-of-science/Nature-of-Science-Teaching-Activities/How-far-can-we-stretch-things>

**Winslow Township School District**  
**Grade 7 Science**  
**Unit 4: Energy and Motion**

**Instructional Best Practices and Exemplars**

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| <ol style="list-style-type: none"><li>1. Identifying similarities and differences</li><li>2. Summarizing and note taking</li><li>3. Reinforcing effort and providing recognition</li><li>4. Homework and practice</li><li>5. Nonlinguistic representations</li></ol> | <ol style="list-style-type: none"><li>6. Cooperative learning</li><li>7. Setting objectives and providing feedback</li><li>8. Generating and testing hypotheses</li><li>9. Cues, questions, and advance organizers</li><li>10. Manage response rates</li></ol> |
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**9.1 Personal Financial Literacy, 9.2 Career Awareness, Exploration, Preparation and Training & 9.4 Life Literacies and Key Skills**

- 9.4.8.CI.2: Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT.3).  
9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.

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

### Grade 7 Science

#### Unit 4: Energy and Motion

##### 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

### Grade 7 Science

#### Unit 4: Energy and Motion

##### 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**  
**Grade 7 Science**  
**Unit 4: Energy and Motion**

English Language Learners	Modifications for Gifted Students
<p>All WIDA Can Do Descriptors can be found at this link:  <a href="https://wida.wisc.edu/teach/can-do/descriptors">https://wida.wisc.edu/teach/can-do/descriptors</a></p> <p><input type="checkbox"/> Grades 6-8 WIDA Can Do Descriptors:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Listening <input type="checkbox"/> Speaking</li> <li><input type="checkbox"/> Reading <input type="checkbox"/> Writing</li> <li><input type="checkbox"/> Oral Language</li> </ul> <p>Students will be provided with accommodations and modifications that may include:</p> <ul style="list-style-type: none"> <li>• Relate to and identify commonalities in Science studies in student’s home country</li> <li>• Assist with organization</li> <li>• Use of computer</li> <li>• Emphasize/highlight key concepts</li> <li>• Teacher Modeling</li> <li>• Peer Modeling</li> <li>• Label Classroom Materials - Word Walls</li> </ul>	<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"> <li>• Raise levels of intellectual demands</li> <li>• Require higher order thinking, communication, and leadership skills</li> <li>• Differentiate content, process, or product according to student’s readiness, interests, and/or learning styles</li> <li>• Provide higher level texts</li> <li>• Expand use of open-ended, abstract questions</li> <li>• Critical and creative thinking activities that provide an emphasis on research and in-depth study</li> <li>• Enrichment Activities/Project-Based Learning/ Independent Study</li> </ul> <p>Additional Strategies may be located at the links:</p> <ul style="list-style-type: none"> <li>❖ <a href="#">Gifted Programming Standards</a></li> <li>❖ <a href="#">Webb’s Depth of Knowledge Levels and/or Revised Bloom’s Taxonomy</a></li> <li>❖ <a href="#">REVISED Bloom’s Taxonomy Action Verbs</a></li> </ul>

**Winslow Township School District**  
**Grade 7 Science**  
**Unit 4: Energy and Motion**

**Interdisciplinary Connections**

**ELA:**

**RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts.

**RST.6-8.3** Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks

**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.

**WHST.6-8.1** Write arguments focused on discipline-specific content.

**WHST.6-8.7** Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration

**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.

**6.RP.A.2** Understand the concept of a unit rate  $a/b$  associated with a ratio  $a:b$  with  $b \neq 0$ , and use rate language in the context of a ratio relationship.

**7.RP.A.2** Recognize and represent proportional relationships between quantities.

**6.EE.A.2** Write, read, and evaluate expressions in which letters stand for numbers.

**7.EE.B.3** Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.

**8.EE.A.1** Know and apply the properties of integer exponents to generate equivalent numerical expressions

**8.EE.A.2** Use square root and cube root symbols to represent solutions to equations of the form  $x^2 = p$  and  $x^3 = p$ , where  $p$  is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that  $\sqrt{2}$  is irrational.

**8.F.A.3** Interpret the equation  $y = mx + b$  as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

**6.NS.C.5** Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

**Winslow Township School District**

**Grade 7 Science**

**Unit 4: Energy and Motion**

**Integration of Computer Science and Design Thinking NJSL 8**

- 8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.
- 8.1.8.DA.4: Transform data to remove errors and improve the accuracy of the data for analysis.
- 8.1.8.DA.5: Test, analyze, and refine computational models.
- 8.1.8.AP.6: Refine a solution that meets users' needs by incorporating feedback from team members and users