

ENERGY AND WAVES (4.PS.NGSS)

NEXT GENERATION SCIENCE STANDARDS

Disciplinary Core Ideas/Performance Assessments	Activities
<p>PS3.A: Definitions of Energy</p> <ul style="list-style-type: none"> The faster a given object is moving, the more energy it possesses. Energy can be moved from place to place by moving objects or through sound, light, or electric currents. 	1,2,3,4,5,7
4-PS3-1: Use evidence to construct an explanation relating the speed of an object to the energy of that object.	1,2,4
4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.	1,3,4,5,6,7,8
4-PS3-3: Ask questions and predict outcomes about the changes in energy that occur when objects collide.	1,2,4
<p>PS3.B: Conservation of Energy and Energy Transfer</p> <ul style="list-style-type: none"> Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. Light also transfers energy from place to place. Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. 	1,2,3,4,5,6,7,8
4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.	1,3,4,5,6,7,8
4-PS3-3: Ask questions and predict outcomes about the changes in energy that occur when objects collide.	1,2,4
4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	3,4,5,6,7,9
<p>PS3.C: Relationship Between Energy and Forces</p> <ul style="list-style-type: none"> When objects collide, the contact forces transfer energy so as to change the objects' motions. 	1,2,8
4-PS3-3: Ask questions and predict outcomes about the changes in energy that occur when objects collide.	1,2,4
<p>PS3.D: Energy in Chemical Processes and Everyday Life</p> <ul style="list-style-type: none"> The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. 	1,4,7,8
4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	3,4,5,6,7,9

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<p>PS4.A: Wave Properties</p> <ul style="list-style-type: none"> Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; it does not move in the direction of the wave except when the water meets the beach. Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). 	6* ,8
<p>4-PS4-1: Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.</p>	3
<p>PS4.C: Information Technologies and Instrumentation</p> <ul style="list-style-type: none"> Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa. 	8
<p>4-PS4-3: Generate and compare multiple solutions that use patterns to transfer information.</p>	2,3,4
<p>ETS1.A: Defining Engineering Problems</p> <ul style="list-style-type: none"> Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. 	5,8
<ul style="list-style-type: none"> 4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. 	3,4,5,6,7,9
<p>ETS1.C: Optimizing the Design Solution</p> <ul style="list-style-type: none"> Different solutions need to be tested in order to determine which of them best solves the problem, given criteria and the constraints. 	5,8
<ul style="list-style-type: none"> 4-PS4-3: Generate and compare multiple solutions that use patterns to transfer information. 	2,3,4

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Science and Engineering Practices	
<p>Asking Questions and Defining Problems Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.</p> <ul style="list-style-type: none"> Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause-and-effect relationships. 	2,3,4,8,
4-PS3-3: Ask questions and predict outcomes about the changes in energy that occur when objects collide.	1,4
<p>Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.</p> <ul style="list-style-type: none"> Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (4-PS3-2) 	2,3,4
4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.	1,3,4,5,6,7,8
<p>Constructing Explanation and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.</p> <ul style="list-style-type: none"> Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4-PS3-1) Apply scientific ideas to solve design problems. (4-PS3-4) 	1,2,3,4,5,6,
4-PS3-1: Use evidence to construct an explanation relating the speed of an object to the energy of that object.	1,2,4
4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	3,4,5,6,7,9
4-PS4-3: Generate and compare multiple solutions that use patterns to transfer information	2,3,4
<p>Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluate the merit and accuracy of ideas and methods.</p> <ul style="list-style-type: none"> Obtain and combine information from books and other reliable media to explain phenomena. 	1,5,6,7,8,
4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.	1,3,4,5,6,7,8
<p>Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.</p> <ul style="list-style-type: none"> Develop a model using an analogy, example, or abstract representation to describe a scientific principle. 	3,5,6,8,
4-PS4-1: Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.	3

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Crosscutting Concepts	
Cause and Effect <ul style="list-style-type: none"> Cause-and-effect relationships are routinely identified and used to explain change. 	1,2,4,5,
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4-PS3-3: Ask questions and predict outcomes about the changes in energy that occur when objects collide.	1,2,4
4-PS4-1: Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.	3
Energy and Matter <ul style="list-style-type: none"> Energy can be transferred in various ways and between objects. 	1,2,3,4,5,
4-PS3-1: Use evidence to construct an explanation relating the speed of an object to the energy of that object.	1,2,4
4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.	1,3,4,5,6,7,8
4-PS3-3: Ask questions and predict outcomes about the changes in energy that occur when objects collide.	1,2,4
4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	3,4,5,6,7,9
Patterns <ul style="list-style-type: none"> Similarities and differences in patterns can be used to sort and classify natural phenomena. Similarities and differences in patterns can be used to sort and classify designed products. 	1,2,4,5
4-PS4-1: Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.	3
4-PS4-3: Generate and compare multiple solutions that use patterns to transfer information.	3,4
Connections to Engineering, Technology, and Applications of Science	
Interdependence of Science, Engineering, and Technology <ul style="list-style-type: none"> Knowledge of relevant scientific concepts and research findings is important in engineering. 	5
4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	3,4,5,6,7,9

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Influence of Engineering, Technology, and Science on Society and the Natural World <ul style="list-style-type: none"> • Engineers improve existing technologies or develop new ones • Over time, people's needs and wants change, as do their demands for new and improved technologies 	8
4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	3,4,5,6,7,9
Connections to Nature of Science	
Science is a Human Endeavor <ul style="list-style-type: none"> • Most scientists and engineers work in teams. • Science affects everyday life. 	1,2,3,4,5,6,7,8,
4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	3,4,5,6,7,9