Disciplinary Core Idea

4.PS4.A: Wave Properties

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; there is no net motion in the direction of the wave except when the water meets a beach. (4-PS4-1)

Disciplinary Core Idea

4.PS4.A: Wave Properties

Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1)

Disciplinary Core Idea

4.PS4.C: Information Technologies and Instrumentation

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. (4-PS4-3)

Disciplinary Core Idea

4.ETS1.C: Optimizing the Design Solution

Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (4-PS4-3)

Disciplinary Core Idea

4.PS3.A: Definitions of Energy

The faster a given object is moving, the more energy it possesses. (4-PS3-1)

Disciplinary Core Idea

4.PS3.A: Definitions of Energy

Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2)

Disciplinary Core Idea

4.PS3.B: Conservation of Energy and Energy Transfer

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. (4-PS3-2)

Disciplinary Core Idea

4.PS3.B: Conservation of Energy and Energy Transfer

Light also transfers energy from place to place. (4-PS3-2)

Disciplinary Core Idea

4.PS3.B: Conservation of Energy and Energy Transfer

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. (4-PS3-2)

Disciplinary Core Idea

4.PS3.A: Definitions of Energy

Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-3)

Disciplinary Core Idea

4.PS3.B: Conservation of Energy and Energy Transfer

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. (4-PS3-3)

Disciplinary Core Idea

4.PS3.C: Relationship Between Energy and Forces

When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3-3)

Disciplinary Core Idea

4.PS3.B: Conservation of Energy and Energy Transfer

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. (4-PS3-4)

Disciplinary Core Idea

4.PS3.D: Energy in Chemical Processes and Everyday Life

The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4)

Disciplinary Core Idea

4.ETS1.A: Defining and Delimiting Engineering Problems

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. (4-PS3-4)

Performance Expectation

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.

Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.
Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.

Performance Expectation

4-PS4-3: Generate and compare multiple solutions that use patterns to transfer information.

Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1's and 0's representing black and white to send information about a picture, and using Morse code to send text.
Assessment Boundary: none

Performance Expectation

4-PS3-1: Use evidence to construct an explanation relating the speed of an object to the energy of that object.

Clarification Statement: none
Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.

Performance Expectation

4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

Clarification Statement: none
Assessment Boundary: Assessment does not include quantitative measurements of energy.

Performance Expectation

4-PS3-3: Ask questions and predict outcomes about the changes in energy that occur when objects collide.

Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.
Assessment Boundary: Assessment does not include quantitative measurements of energy.

Performance Expectation

4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.
Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.

Science and Engineering Practice

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.

Develop a model using an analogy, example, or abstract representation to describe a scientific principle. (4-PS4-1)

Science and Engineering Practice

Constructing Explanations 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.

Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-PS4-3)

Science and Engineering Practice

Constructing Explanations 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.

Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4-PS3-1)

Science and Engineering Practice

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.

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)

Science and Engineering Practice

Asking Questions and Defining Problems

Asking questions and defining problems in grades 3–5 builds from grades K–2 experiences and progresses to specifying qualitative relationships.

Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4-PS3-3)

Science and Engineering Practice

Constructing Explanations 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.

Apply scientific ideas to solve design problems. (4-PS3-4)

Crosscutting Concept

Patterns

Similarities and differences in patterns can be used to sort and classify natural phenomena. (4-PS4-1)

Crosscutting Concept

Patterns

Similarities and differences in patterns can be used to sort and classify designed products. (4-PS4-3)

Crosscutting Concept

Energy and Matter

Energy can be transferred in various ways and between objects. (4-PS3-1)

Crosscutting Concept

Energy and Matter

Energy can be transferred in various ways and between objects. (4-PS3-2)

Crosscutting Concept

Energy and Matter

Energy can be transferred in various ways and between objects. (4-PS3-3)

Crosscutting Concept

Energy and Matter

Energy can be transferred in various ways and between objects. (4-PS3-4)

Connection to Nature of Science

Science Knowledge Is Based on Empirical Evidence

Science findings are based on recognizing patterns. (4-PS4-1)

Connection to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

Knowledge of relevant scientific concepts and research findings is important in engineering. (4-PS4-3)

Connection to Engineering, Technology, and Applications of Science

Science Is a Human Endeavor

Science affects everyday life. (4-PS3-4)

Connection to Engineering, Technology, and Applications of Science

Science Is a Human Endeavor

Most scientists and engineers work in teams. (4-PS3-4)

Connection to Engineering, Technology, and Applications of Science

Influence of Science, Engineering, and Technology on Society and the Natural World

Engineers improve existing technologies or develop new ones. (4-PS3-4)

Common Core State Standards for ELA/Literacy

Reading Informational Text

RI.4.1 - Key Ideas and Details

Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-PS4-3)

Common Core State Standards for ELA/Literacy

Reading Informational Text

RI.4.9 - Integration of Knowledge and Ideas

Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS4-3)

Common Core State Standards for ELA/Literacy

Speaking & Listening

SL.4.5 - Presentation of Knowledge and Ideas

Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-PS4-1)

Common Core State Standards for Mathematics

Geometry

4.G.A.1 - Draw and identify lines and angles, and classify shapes by properties of their lines and angles.

Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. (4-PS4-1)

Common Core State Standards for Mathematics

Mathematical Practices

MP.4 - Model with mathematics

Model with mathematics. (4-PS4-1)