

## ***Science Standards – Topics and Pacing Guide***

4th Grade



The performance expectations in fourth grade help students formulate answers to questions such as: “What are waves and what are some things they can do? How can water, ice, wind and vegetation change the land? What patterns of Earth’s features can be determined with the use of maps? How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals? What is energy and how is it related to motion? How is energy transferred? How can energy be used to solve a problem?” Students are able to use a model of waves to describe patterns of waves in terms of amplitude and wavelength, and that waves can cause objects to move. Students are expected to develop understanding of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. They apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of such processes on humans. In order to describe patterns of Earth’s features, students analyze and interpret data from maps. Fourth graders are expected to develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. By developing a model, they describe that an object can be seen when light reflected from its surface enters the eye. Students are able to use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object. Students are expected to develop an understanding that energy can be transferred from place to place by sound, light, heat, and electric currents or from object to object through collisions. They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another. The crosscutting concepts of patterns; cause and effect; energy and matter; systems and system models; interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. In the fourth grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in asking questions, developing and using models, planning and carrying out investigations, analyzing and interpreting data, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information. Students are expected to use these practices to demonstrate understanding of the core ideas.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication

### 4th Next Generation Science Standards

Alignment and integration has been made to the current science series, “Harcourt Science” and the NGSS Interactive Science Notebook Grade 4. Scientific inquiry and engineering activities have been suggested for the purpose of addressing the skills in the context of the standards. Teachers have the flexibility to adjust within a trimester as they determine appropriate but should keep with the identified topics and standards that have been specified within that trimester. This alignment ensures that skills are not missed and that all elementary schools are following the same path.

When	Content Standards	Topics	Key Concepts/ Vocabulary	Alignment and Integration	Suggested Scientific Inquiry Activities	Suggested Engineering Activities
1 <sup>st</sup> Trimester	<b>4-LS1-1</b> Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.	From Molecules to Organisms: Structure and Processes	<b>How do the structures of organisms enable life's functions?</b>  environment, climate, oxygen, shelter, metamorphosis, adaptation, camouflage, mimicry, instinct, migration hibernation, carbon dioxide, nutrient, photosynthesis, dormancy, transpiration, taproot, fibrous root, germinate stamen, pistil, pollination, spore tuber	Harcourt Science Unit A: Chapters 2 and 3	NGSS 'Notebook': -External Animal - Structures pg. 31  -Internal Animal Structures pg. 33  -External Plant Structures pg. 35  -Internal Plant Structures pg. 37	Harcourt Science Bird Beaks and Food Activity A46-A47
	<b>4-LS1-2</b> Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.		<b>How do organisms detect, process, and use information about the environment?</b>  brain neuron nerve spinal cord esophagus stomach small intestine large intestine	Harcourt Science Unit A: Chapter 4, Lesson 3	NGSS 'Notebook': -Nervous System pg. 39	Build a Headphone <a href="http://pbskids.org/designteam/build/headphone-helper/">http://pbskids.org/designteam/build/headphone-helper/</a>

When	Content Standards	Topics	Key Concepts/ Vocabulary	Alignment and Integration	Suggested Scientific Inquiry Activities	Suggested Engineering Activities
2 <sup>nd</sup> Trimester	<b>4-ESS1-1</b> Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.	<b>Earth's Place in the Universe</b>	<b>How do people reconstruct and date events in Earth's planetary history?</b>  fossil, trace fossil, mold, cast	Harcourt Science Unit C: Chapter 2: Lessons 1 and 2	NGSS 'Notebook': Fossils pg. 41 Canyons pg. 43	Making a Fossil Harcourt C34-C35
	<b>4-ESS2-1</b> Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.	<b>Earth's Systems</b>	<b>How do Earth's major systems interact?</b> <b>How do living organisms alter Earth's processes and structures?</b>  weathering, erosion	Harcourt Science Grade 3 Science: Unit C, Chapter 2, Lesson 2	NGSS 'Notebook': -Causes of Weathering pg. 45 -Testing Effects of Erosion pg. 47	
	<b>4-ESS2-2</b> Analyze and interpret data from maps to describe patterns of Earth's features.		<b>Why do the continents move, and what causes earthquakes and volcanoes?</b>  crust, mantle, core, plate, earthquake, fault focus, epicenter, seismograph, volcano magma, lava, crater magma chamber	Harcourt Science Unit C: Chapter 1, Lessons 1 – 3	NGSS 'Notebook': -Physical Maps pg. 52 -Topographic Maps pg. 54	Earthquakes Activity Harcourt C12-C13

<p>2<sup>nd</sup> Trimester</p>	<p><b>4-ESS3-1</b> Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.</p> <p><b>4-ESS3-2</b> Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.</p>	<p><b>Earth and Human Activity</b></p>	<p><b>How do humans depend on Earth's resources?</b></p> <p>fossil fuels petroleum natural gas peat lignite bituminous coal anthracite</p> <p><b>How do natural hazards affect individuals and societies?</b></p> <p><b>What is the process for developing potential design solutions?</b></p>	<p>Harcourt Science Unit C: Chapter 2, Lesson 3</p>	<p>NGSS 'Notebook': -Formation of Coal pg. 56 -Formation of Oil pg. 58 -Evaluating Fossil Fuels pg. 60 -Wind Energy pg. 62 -Solar Energy pg. 64 -Hydroelectric Energy pg. 66</p> <p>Harcourt C50-C51 -What Kinds of Rocks -Store Petroleum Activity</p> <p>Harcourt Science Unit C: Chpt. 1 Experiment: Earthquake-Resistant Structures: Teachers Edition C1i-j</p>	<p>Working with Wind Energy Activity</p> <p><a href="http://tryengineering.org/lesson-plans/working-wind-energy">http://tryengineering.org/lesson-plans/working-wind-energy</a></p> <p>NGSS 'Notebook': -Resisting Earthquakes pg. 68</p>
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When	Content Standards	Topics	Key Concepts/ Vocabulary	Alignment and Integration	Suggested Scientific Inquiry Activities	Suggested Engineering Activities
3 <sup>rd</sup> Trimester	<p><b>4-PS3-1</b> Use evidence to construct an explanation relating the speed of an object to the energy of that object.</p> <p><b>4-PS3-2</b> Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.</p> <p><b>4-PS3-3</b> Ask questions and predict outcomes about the changes in energy that occur when objects collide.</p>	Energy	<p><b>What is energy?</b> energy kinetic energy thermal energy temperature</p> <p><b>What is meant by conservation of energy?</b> <b>How is energy transferred between objects or systems?</b></p> <p>Heat, conduction convection, radiation infrared radiation, fuel solar energy, sound, compression, amplitude, wavelength electric current, circuit electric cell, conductor resistor, series circuit, parallel circuit</p> <p><b>How are forces related to energy?</b> acceleration newton</p> <p>gravity, weight, friction</p>	<p>Harcourt Science Unit E, Chpt. 2 Lesson 1</p> <p>Harcourt Science Unit E: Chapter 2, Lessons 2 – 3 Unit E: Chapter 3 Lesson1 Unit F: Chapter 1 Lesson 2</p>	<p>NGSS ‘Notebook’: -Speed of Energy Investigation pg. 6</p> <p>-Speed of Energy Relationship pg. 9</p> <p>NGSS ‘Notebook’: -Introduction to Energy Transfer pg. 15</p> <p>-Light Energy from the Sun pg. 17</p> <p>-Transfer of Energy Part 2 pg. 19</p> <p>-Exploring Circuit pg. 21</p>	<p>Ramps and Rollers Design Experiment</p> <p>Harcourt E46-E47 Hot Air Activity</p>

<p>3<sup>rd</sup> Trimester</p>	<p><b>4-PS3-4</b> Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.</p> <p><b>4-PS4-1</b> Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.</p> <p><b>4-PS4-2</b> Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.</p>	<p><b>Waves and their Applications in Technologies for Information Transfer</b></p>	<p><b>How do food and fuel provide energy? If energy is conserved, why do people say it is produced or used?</b></p> <p><b>What is a design for? What are the criteria and constraints of a successful solution?</b></p> <p>energy kinetic energy thermal energy temperature</p> <p><b>What are the characteristic properties and behaviors of waves?</b></p> <p>sound, compression amplitude, wavelength loudness, pitch</p> <p><b>What is light? How can one explain the varied effects that involve light? What other forms of electromagnetic radiation are there?</b> reflection, refraction absorption, opaque translucent, transparent</p>	<p>Harcourt Science Unit F: Chapter 2, Lesson 2 and 3</p> <p>Harcourt Science Unit E: Chapter 2, Lessons 1</p> <p>Unit E: Chapter 3, Lessons 1 and 2</p> <p>Unit E: Chapter 4, Lesson 1</p>	<p>NGSS 'Notebook': -Changes in Energy pg. 23</p> <p>NGSS 'Notebook': pg. 25 Sound Waves</p> <p>NGSS 'Notebook': -Reflection/Light Model pg. 27</p> <p>Harcourt E98-E99 How Light Travels Activity</p>	<p>Pairs of Forces Acting on Objects Harcourt F44-F45</p> <p>NGSS 'Notebook': -Energy Device pg. 24</p> <p>Sound from a Ruler Harcourt E68-E69</p>
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<p>3<sup>rd</sup> Trimester</p>	<p><b>4-PS4-3</b> Generate and compare multiple solutions that use patterns to transfer information.</p> <p><b>3-5-ETS1-1</b> Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.</p> <p><b>3-5-ETS1-2</b> Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.</p> <p><b>3-5-ETS1-3</b> Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.</p>	<p><b>Engineering Design</b></p>	<p><b>How are instruments that transmit and detect waves used to extend human senses?</b></p> <p><b>How can the various proposed design solutions be compared and improved?</b></p> <p><b>What is a design for? What are the criteria and constraints of a successful solution?</b></p> <p><b>What is the process for developing potential design solutions?</b></p> <p><b>How can the various proposed design solutions be compared and improved?</b></p>	<p>Imbed these ideas throughout the year</p>	<p>NGSS 'Notebook': -Morse Code pg. 29</p>	<p>Ramps and Rollers Design a Roller Coaster Activity</p>
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