### 4th Grade Topical Model

**Narrative and Rationale:** The five bundles in this Grade 4 model all have a particular topical focus. Bundle 1 focuses on organism structure and function and information processing. In Bundle 2, the abstract concept of energy transfer is introduced alongside a focus on information transfer. Bundle 3 extends the study of energy to include cause and effect relationships between energy and collisions. In Bundle 4, students are introduced to waves and their properties. The idea that waves can cause objects to move can be used to facilitate student understanding of the scale of the rate of weathering or erosion in certain environments. Bundle 5 builds on the third grade focus on force to facilitate students’ understanding of Earth systems and their processes of change. Opportunities also exist to connect back to concepts of energy transfer introduced earlier in the year.

There are a variety of opportunities to incorporate the 3–5 engineering design performance expectations throughout the year. Although these performance expectations are included in this 4th grade model, they will be fully assessable at the end of grade five. The science and engineering practices and crosscutting concepts in the fourth grade performance expectations enable students to develop a concrete understanding of phenomena associated with energy transfer. Note that the practices and crosscutting concepts described are intended as end-of-instructional unit expectations and not curricular designations—additional practices and crosscutting concepts should be used throughout instruction in each bundle.

<table>
<thead>
<tr>
<th>Bundle 1: How do organisms receive and process information? ~6 weeks</th>
<th>Bundle 2: How do we move energy and information from place to place? ~9 weeks</th>
<th>Bundle 3: What happens when objects collide? ~6 weeks</th>
<th>Bundle 4: What effect can water have on land? ~6 weeks</th>
<th>Bundle 5: How can we reduce negative impacts of natural hazards and of resource use? ~9 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. <strong>4-LS1-1.</strong> Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. <strong>4-LS1-2.</strong> 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. <strong>3-5-ETS1-1.</strong> Define a simple design problem reflecting a</td>
<td>4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. <strong>4-PS3-4.</strong> Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. <strong>4-PS4-3.</strong> Generate and compare multiple solutions that use patterns to transfer information.*</td>
<td>4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object. <strong>4-PS3-3.</strong> Ask questions and predict outcomes about the changes in energy that occur when objects collide. <strong>3-5-ETS1-3.</strong> 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.*</td>
<td>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. <strong>4-ESS1-1.</strong> Identify evidence from patterns in rock formations and fossils in rock layers for changes in a landscape over time to support an explanation for changes in a landscape over time. <strong>4-ESS2-1.</strong> Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. <strong>3-5-ETS1-2.</strong> Generate and compare multiple possible solutions to a problem based on</td>
<td>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. <strong>4-ESS2-2.</strong> Analyze and interpret data from maps to describe patterns of Earth’s features. <strong>4-ESS3-1.</strong> Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. <strong>4-ESS3-2.</strong> Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.* <strong>3-5-ETS1-2.</strong> Generate and compare multiple possible solutions to a problem based on</td>
</tr>
<tr>
<td>need or a want that includes specified criteria for success and constraints on materials, time, or cost.*</td>
<td>solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.¹*</td>
<td>how well each is likely to meet the criteria and constraints of the problem.*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹. The bundle only includes part of this PE; the PE is not fully assessable in a unit of instruction leading to this bundle.
**NGSS Example Bundles**

**Bundle 1**
- PS3.B as found in 4-PS3-2
  - 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.

**Bundle 2**
- LS1.A as found in 4-LS1-1
  - Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
  
- LS1.D as found in 4-LS1-2
  - Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions.

**Bundle 3**
- ETS1.A as found in 4-ETS1-1
  - 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.

- PS3.A as found in 4-PS3-3
  - The faster a given object is moving, the more energy it possesses.

- PS3.B as found in 4-PS3-3
  - Energy can be moved from place to place by moving objects or through sound, light, or electric currents.

- PS3.C as found in 4-PS3-3
  - When objects collide, the contact forces transfer energy so as to change the objects' motion.

- PS3.D as found in 4-PS3-4
  - The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use.

- PS4.B as found in 4-PS4-2
  - An object can be seen when light reflected from its surface enters the eyes.

**Bundle 4**
- ETS1.B as found in 4-ETS1-2
  - Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.

- ETS1.C as found in 4-ETS1-3
  - Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

- ETS1.L as found in 3-ETS1-3
  - Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.

**Bundle 5**
- ESS2.A as found in 4-ESS2-1
  - Living things affect the physical characteristics of their regions.

- ESS2.B as found in 4-ESS2-1
  - Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

- ESS2.L as found in 4-ESS2-2
  - Living things affect the physical characteristics of their regions.

- ESS2.S as found in 4-ESS2-2
  - Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain rock types indicate the order in which rock layers were formed.

- ESS3.A as found in 4-ESS3-1
  - Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not.

- ESS3.B as found in 4-ESS3-2
  - A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts.

- ESS3.L as found in 4-ESS3-2
  - Testing a solution involves investigating how well it performs under a range of likely conditions.

- ESS3.S as found in 4-ESS3-2
  - For time, and others are not.