4-PS4 Waves and their Applications in Technologies for Information Transfer

**Science and Engineering Practices**

**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)
  - Develop a model to describe phenomena. (4-PS4-2)

**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)

**Disciplinary Core Ideas**

**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. (Note: This grade band endpoint was moved from K–2.) (4-PS4-1)
- Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1)

**PS4.B: Electromagnetic Radiation**
- An object can be seen when light reflected from its surface enters the eyes. (4-PS4-2)

**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)

**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. (secondary to 4-PS4-3)

**Crosscutting Concepts**

- Patterns
  - Similarities and differences in patterns can be used to sort and classify natural phenomena. (4-PS4-1)
  - Similarities and differences in patterns can be used to sort and classify designed products. (4-PS4-3)

- Cause and Effect
  - Cause and effect relationships are routinely identified. (4-PS4-2)

**Connections to Nature of Science**

- Connections to other DCIs in fourth grade: 4.PS3.A (4-PS4-1); 4.PS3.B (4-PS4-1); 4.E.TS1.A (4-PS4-3)

- Articulation of DCIs across grade levels: K.E.TS1.A (4-PS4-3); 1.PS4.B (4-PS4-2); 1.PS4.C (4-PS4-3); 2.E.TS1.B (4-PS4-3); 2.E.TS1.C (4-PS4-3); 3.PS2.A (4-PS4-3); MS.PS4.A (4-PS4-1); MS.PS4.B (4-PS4-2); MS.PS4.C (4-PS4-3); MS.LS1.D (4-PS4-2); MS.E.TS1.B (4-PS4-3)

**ELA/Literacy**

- RI.4.1 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)
- RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS4-3)
- SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-PS4-1),(4-PS4-2)

**Mathematics**

- MP.4 Model with mathematics. (4-PS4-1),(4-PS4-2)
- 4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. (4-PS4-1),(4-PS4-2)

*The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea. The section entitled “Disciplinary Core Ideas” is reproduced verbatim from A Framework for K–12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas. Integrated and reprinted with permission from the National Academy of Sciences.