

# MS-PS4 Waves and Their Applications in Technologies for Information Transfer

## MS-PS4 Waves and Their Applications in Technologies for Information Transfer

Students who demonstrate understanding can:

- MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.** [Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.] [Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.]
- MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.** [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]
- MS-PS4-3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.** [Clarification Statement: Emphasis is on a basic understanding that waves can be used for communication. Examples of models could include fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of text on a computer screen.] [Assessment Boundary: Assessment does not include binary counting.]
- Clarification statements provide additional clarification to the PE

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

### Science and Engineering Practices

#### Developing and Using Models

Modeling in 6–8 builds on K–5 and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop and use a model to describe phenomena. (MS-PS4-2)

#### Using Mathematics and Computational Thinking

Mathematical and computational thinking at the 6–8 level builds patterns in concepts to

- Use mathematical and/or computational solutions

#### Obtaining, Evaluating, and Communicating Information

Obtaining, evaluating, and communicating information in 6–8 builds on K–5 and progresses to evaluating the ideas and methods.

Integrate qualitative scientific and technical written text with that contained in visual displays to clarify claims and (MS-PS4-3)

#### Connections to Nature of Science

#### Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS4-1)

### Disciplinary Core Ideas

#### PS4.A: Wave Properties

- A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)
- A sound wave needs a medium through which it is transmitted. (MS-PS4-2)

#### PS4.B: Electromagnetic Radiation

- When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2)
- The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. (MS-PS4-2)
- A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2)
- However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2)

#### PS4.C: Information Technologies and Instrumentation

- Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information than analog signals. (MS-PS4-3)

Codes in parentheses designate which of the performance expectations above incorporate this disciplinary core idea

### Crosscutting Concepts

#### Patterns

- Graphs and charts can be used to identify patterns in data. (MS-PS4-1)

#### Structure and Function

- Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS4-2)
- Structures can be designed to serve particular functions (MS-PS4-3)

Codes in parentheses designate which of the performance expectations above incorporate this crosscutting concept

#### Interactions and Technology on Society and the Natural World

- Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3)

#### Connections to Nature of Science

#### Science is a Human Endeavor

- Advances in technology influence the progress of science and science has influenced advances in technology. (MS-PS4-3)

Connections to other DCIs in this grade-band: **MS.LS1.D** (MS-PS4-2)

Articulation across grade-bands: **4.PS3.A** (MS-PS4-1); **4.PS3.B** (MS-PS4-1); **4.PS4.A** (MS-PS4-1); **4.PS4.B** (MS-PS4-2); **4.PS4.C** (MS-PS4-3); **HS.PS4.A** (MS-PS4-1),(MS-PS4-2),(MS-PS4-3); **HS.PS4.B** (MS-PS4-1),(MS-PS4-2); **HS.PS4.C** (MS-PS4-3); **HS.ESS1.A** (MS-PS4-2); **HS.ESS2.A** (MS-PS4-2); **HS.ESS2.C** (MS-PS4-2); **HS.ESS2.D** (MS-PS4-2)

Common Core State Standards Connections:

ELA/Literacy –

**RST.6-8.1**

Cite specific textual evidence

technical texts. (MS-PS4-3)

**RST.6-8.2**

Determine the central ideas

accurate summary of the text distinct from prior knowledge or opinions. (MS-PS4-3)

**RST.6-8.9**

Compare and contrast the text on the same topic. (MS-PS4-3)

simulations, video, or multimedia sources with that gained from reading a

**WHST.6-8.9**

Draw evidence from informational texts to support analysis, reflection, and research. (MS-PS4-3)

**SL.8.5**

Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS4-1),(MS-PS4-2)

Mathematics –

**MP.2**

Reason abstractly and quantitatively. (MS-PS4-1)

**MP.4**

Model with mathematics. (MS-PS4-1)

**6.RP.A.1**

Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS4-1)

**6.RP.A.3**

Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS4-1)

**7.RP.A.2**

Recognize and represent proportional relationships between quantities. (MS-PS4-1)

**8.F.A.3**

Interpret the equation  $y = mx + b$  as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (MS-PS4-1)

Some performance expectations have an asterisk:

\* Performance expectations marked with an asterisk integrate traditional science content with engineering through a practice or disciplinary core idea

Assessable Components

Foundation Boxes

Connection Boxes