

4-PS4-1 Waves and Their Applications in Technologies for Information Transfer

California Science Test—Item Content Specifications

# 4-PS4-1 Waves and Their Applications in Technologies for Information Transfer

Students who demonstrate understanding can:

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.*]

Continue to the next page for the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts.

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| 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.  Connections to Nature of Science  Scientific Knowledge is Based on Empirical Evidence  Science findings are based on recognizing patterns. | PS4.A: Wave Properties   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. (Note: This grade band endpoint was moved from K–2.) 2. Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). | Patterns  Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena. |

## Assessment Targets

Assessment targets describe the focal knowledge, skills, and abilities for a given three-dimensional Performance Expectation. Please refer to the Introduction for a complete description of assessment targets.

### Science and Engineering Subpractice(s)

Please refer to appendix A for a complete list of Science and Engineering Practices (SEP) subpractices. Note that the list in this section is not exhaustive.

2.1 Ability to develop models

2.2 Ability to use models

### Science and Engineering Subpractice Assessment Targets

Please refer to appendix A for a complete list of SEP subpractice assessment targets. Note that the list in this section is not exhaustive.

2.1.1 Ability to determine components of a scientific event, system, or design solution

2.1.2 Ability to determine the relationships among multiple components of a scientific event, system, or design solution

2.2.1 Ability to use models to identify concepts and relationships represented in the models

2.2.2 Ability to use models to generate explanations and predictions about a scientific phenomenon

### Disciplinary Core Idea Assessment Targets

#### PS4.A.2

* Recognize phenomena that exhibit wave behavior (e.g., the repeating pattern of crests and troughs)
* Describe how waves may be created in various media
* Recognize the basic properties of waves, such as amplitude and wavelength
* Relate the up and down motion of an object carried by a passing wave to the amplitude and wavelength of the wave
* Describe that there is generally no net motion of the medium (e.g., water) in the direction of propagation of the wave

#### PS4.A.3

* Understand that waves of the same type can have different amplitudes and wavelengths
* Describe how changes in the amplitude and wavelength of a passing wave affect the motion of an object carried by the wave

### Crosscutting Concept Assessment Target(s)

CCC1 Use similarities and differences in patterns to sort, classify, and analyze simple rates of change for natural phenomena

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides both a description of a phenomenon that involves wave behavior and a list of relevant and irrelevant components to include in a model:

* Selects the components to develop a model that illustrates/explains the phenomenon (2.1.1, PS4.A.2, and CCC1)

Task provides a description of a phenomenon that involves wave behavior and an incomplete model that illustrates/explains the phenomenon:

* Identifies the components that will complete the model (2.1.1, PS4.A.2, and CCC1)
* Explains the role of the components in the model (2.1.1, PS4.A.2, and CCC1)

Task provides both a description of a phenomenon that involves wave behavior and a list of models to illustrate/explain a behavior about the phenomenon (e.g., there is no net movement of water toward the shore in a deep-water wave):

* Selects the model that illustrates/explains the behavior (2.1.1, PS4.A.2, and CCC1)

Task provides a physical model of a phenomenon that involves wave behavior and observations/evidence from the model:

* Identifies the relationships in the model based on the observations/evidence (2.2.1, PS4.A.3, and CCC1)

Task provides a model of a phenomenon that involves wave behavior:

* Uses the model to construct an explanation about phenomenon (2.2.2, PS4.A.3, and CCC1)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Observations of the motion of an object floating on water when the water is disturbed
* Modeling of transverse and longitudinal waves using ropes, strings, and springs
* Analysis of wave movement and wave shape

## Common Misconceptions

Note that the list in this section is not exhaustive.

* When deep water waves move, there is a net movement of the water in the direction the waves move.
* The amplitude of a wave is the same as its wavelength.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

4-PS4-1 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/4-PS4-1 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/4-PS4-1%20Evidence%20Statements%20June%202015%20asterisks.pdf)

The *2016 Science Framework for California Public Schools Kindergarten through Grade 12*

[Appendix 1: Progression of the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts in Kindergarten through Grade 12](https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix1.pdf) <https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix1.pdf>

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