

4-PS3-1 Energy

California Science Test—Item Content Specifications

# 4-PS3-1 Energy

Students who demonstrate understanding can:

Use evidence to construct an explanation relating the speed of an object to the energy of that object.

[Clarification Statement: Examples of evidence relating speed and energy could include change of shape on impact or other results of collisions.] [*Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.*]

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| 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.  Use evidence (e.g., measurements, observations, patterns) to construct an explanation. | PS3.A: Definitions of Energy   1. The faster a given object is moving, the more energy it possesses. | Energy and Matter  Energy can be transferred in various ways and between objects. |

## 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.

6.1 Ability to construct explanations of phenomena

### 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.

6.1.1 Ability to construct quantitative and/or qualitative explanations of observed relationships based on valid and reliable evidence

6.1.2 Ability to apply scientific concepts, principles, theories, and big ideas to construct an explanation of a real-world phenomenon

6.1.3 Ability to use models and representations in scientific explanations

### Disciplinary Core Idea Assessment Targets

#### PS3.A.1

* Identify and describe the relative speeds of objects (i.e., faster or slower)
* Describe that the speed of an object is related to the (kinetic) energy of an object
* Recognize that energy is transferred between objects in various ways, such as collisions
* Recognize that indicators, such as heat, sound, change of shape, and change in motion are qualitative measures of the amount of energy transferred from one object to another
* Construct and articulate the idea, based on observational evidence, that for a given mass, the faster an object is moving the more energy it possesses

### Crosscutting Concept Assessment Target(s)

CCC5 Identify the ways that energy is transferred between objects

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides a description of an experiment and observations that demonstrate the relationship between the speed of an object and its energy:

* Uses the observations to make a qualitative conclusion about the relationship between dependent and independent variables of the experiment (6.1.1, PS3.A.1, and CCC5)

Task provides a description of a real-world phenomenon and additional observations or data from an experiment about the phenomenon that demonstrate the relationship between the speed of an object and its energy:

* Uses observations or data and scientific concepts about energy to support a conclusion about how the speed of the object is related to its energy (6.1.2, PS3.A.1, and CCC5)
* Selects or completes a model that is the best representative explanation of the phenomenon (6.1.3, PS3.A.1, and CCC5)

Task provides a scientific model of a phenomenon that illustrates the relationship between the speed of an object and its energy:

* Uses the model to construct an explanation of how the speed of an object is related to its energy (6.1.3, PS3.A.1, and CCC5)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Relationship between speed of a moving object (e.g., baseball, toy car, skateboard) and one of the following:
  + Loudness of the sound produced during a collision with a stationary object
  + Amount of kinetic energy of the moving object
  + Amount of thermal energy caused by friction between the moving object and a surface
* Distance a stationary object moves after a force is applied (e.g., a rolling ball collides with a stationary ball)
* Size of an indentation (e.g., a crater) relative to the speed of a moving object (e.g., a meteorite)

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Speed is the only factor that determines the kinetic energy of a moving object.
* Faster moving objects always have more kinetic energy than slower moving objects.

## Additional Assessment Boundaries

Students are not expected to have mastery of the terms “thermal energy” or “kinetic energy”.

## Additional References

[4-PS3-1 Evidence Statement](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/4-PS3-1%20Evidence%20Statements%20June%202015%20asterisks.pdf) <https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/4-PS3-1%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>

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