

4-PS3-3 Energy

California Science Test—Item Content Specifications

# 4-PS3-3 Energy

Students who demonstrate understanding can:

Ask questions and predict outcomes about the changes in energy that occur when objects collide.

[Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.] [*Assessment Boundary: Assessment does not include quantitative measurements of energy.*]

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 |
| --- | --- | --- |
| Asking Questions and Defining Problems  Asking questions and defining problems in grades 3–5 builds on grades K–2 experiences and progresses to specifying qualitative relationships.  Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. | PS3.A: Definitions of Energy  2. Energy can be moved from place to place by moving objects or through sound, light, or electric currents.  PS3.B: Conservation of Energy and Energy Transfer  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.  PS3.C: Relationship Between Energy and Forces  2. When objects collide, the contact forces transfer energy so as to change the objects’ motions. | 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.

1.1 Ability to ask and evaluate questions addressing phenomena of the natural world

1.2 Ability to ask and evaluate scientific questions arising from examining models, explanations, and arguments to specify relationships between variables

### 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.

1.1.1 Ability to ask questions that arise from careful observation of phenomena or unexpected results

1.2.1 Ability to ask questions that clarify and refine a model or an explanation

1.2.2 Ability to ask questions that determine relationships, including qualitative and quantitative relationships, between independent and dependent variables

### Disciplinary Core Idea Assessment Targets

#### PS3.A.2

* Recognize that motion, sound, heat, and light are forms of energy
* Recognize that relative speed, loudness, temperature, and brightness are qualitative measures of energy

#### PS3.B.2

* Recognize that energy changes occur when objects collide but the total energy of the objects and the surroundings is conserved
* Describe that some energy is transferred from one object to another during a collision, resulting in a change in motion of the objects
* Describe that some energy is transferred from the objects during a collision to the surrounding air, resulting in sound and heat

#### PS3.C.2

* Describe that contact forces exerted by colliding objects transfer energy, resulting in a change in motion of the objects

### Crosscutting Concept Assessment Target(s)

CCC5 Identify that energy can be transferred in various ways and between objects

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides a picture, description, or simulation of a phenomenon involving the transfer of energy during a collision:

* Asks questions about observable features of the phenomena (such as flashes of light, changes in temperature, sound) that are indicative of transfers of energy and/or the amount of energy transferred (1.1.1, PS3.A.2, and CCC5)
* Identifies the question(s) about the changes in energy as a result of the collision that can be investigated (1.1.1, PS3.B.2, and CCC5)

Task provides a model that illustrates the transfer of energy during a collision:

* Identifies the question(s) about the changes in energy as a result of the collision that can be answered using the model (1.2.1, PS3.B.2, and CCC5)
* Generates a question that can be used to test a prediction of the changes in energy as a result of the collision (1.2.1, PS3.B.2, and CCC5)

Task provides a description of an experiment involving the transfer of energy during a collision:

* Identifies the investigable question(s) about the relationships between the independent and dependent variables in the experiment (1.2.2, PS3.C.2, and CCC5)
* Proposes a question that can be used to test a prediction based on the relationships between the variables in the experiment (1.2.2, PS3.C.2, and CCC5)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Two moving objects (e.g., carts, balls) collide or a moving object and a stationary object collide, producing changes in energy or speed
* An object strikes another, producing movement and sound

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Energy is lost (not conserved) during collisions.
* Energy transfer from one object or form to another is one hundred percent efficient.
* Energy and force are interchangeable terms.
* Doubling the speed of an object doubles the kinetic energy.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

[4-PS3-3 Evidence Statement](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/4-PS3-3%20Evidence%20Statements%20June%202015%20asterisks.pdf) <https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/4-PS3-3%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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