

4-PS3-1 Energy

Students who demonstrate understanding can:

- 4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.** *[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.]*

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

Science and Engineering Practices

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.

Disciplinary Core Ideas

PS3.A: Definitions of Energy

- The faster a given object is moving, the more energy it possesses.

Crosscutting Concepts

Energy and Matter

- Energy can be transferred in various ways and between objects.

Observable features of the student performance by the end of the grade:

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| 1 | Articulating the explanation of phenomena | |
| | a | Students articulate a statement that relates the given phenomenon to a scientific idea, including that the speed of a given object is related to the energy of the object (e.g., the faster an object is moving, the more energy it possesses). |
| | b | Students use the evidence and reasoning to construct an explanation for the phenomenon. |
| 2 | Evidence | |
| | a | Students identify and describe* the relevant given evidence for the explanation, including: |
| | | <ul style="list-style-type: none"> i. The relative speed of the object (e.g., faster vs. slower objects). ii. Qualitative indicators of the amount of energy of the object, as determined by a transfer of energy from that object (e.g., more or less sound produced in a collision, more or less heat produced when objects rub together, relative speed of a ball that was stationary following a collision with a moving object, more or less distance a stationary object is moved). |
| 3 | Reasoning | |
| | a | Students use reasoning to connect the evidence to support an explanation for the phenomenon. In the explanation, students describe* a chain of reasoning that includes: |
| | | i. Motion can indicate the energy of an object. |
| | | ii. The faster a given object is moving, the more observable impact it can have on another object (e.g., a fast-moving ball striking something (a gong, a wall) makes more noise than does the same ball moving slowly and striking the same thing). |
| | | iii. The observable impact of a moving object interacting with its surroundings reflects how much energy was able to be transferred between objects and therefore relates to the energy of the moving object. |
| | | iv. Because faster objects have a larger impact on their surroundings than objects moving more slowly, they have more energy due to motion (e.g., a fast-moving ball striking a gong makes more noise than a slow-moving ball doing the same thing because it has more energy that can be transferred to the gong, producing more sound). [Note: This refers only to relative bulk motion energy, not potential energy, to remain within the DCI.] |
| v. Therefore, the speed of an object is related to the energy of the object. | | |