

HS-PS2-6 Motion and Stability: Forces and Interactions

California Science Test—Item Content Specifications

# HS-PS2-6 Motion and Stability: Forces and Interactions

Students who demonstrate understanding can:

Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

[Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.] [*Assessment Boundary: Assessment is limited to provided molecular structures of specific designed materials.*]

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| Science and Engineering Practices  Obtaining, evaluating, and communicating information in 9–12 builds on K–8 and progresses to evaluating the validity and reliability of the claims, methods, and designs.  Communicate scientific and technical information (e.g., about the process of development and the design and performance of a proposed process or system) in multiple formats (including oral, graphical, textual and mathematical). | PS2.B: Types of Interactions  8. Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. | Structure and Function  Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. |

## 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.

8.2 Ability to communicate about science and engineering (especially regarding the investigations conducted and the observations made)

### 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.

8.2.2 Ability to use appropriate combinations of language, models, and mathematical expressions to communicate one’s understanding or to ask questions about a concept, event, system, or design

### Disciplinary Core Idea Assessment Targets

#### PS2.B.8

* Identify the molecular structure of the designed materials to describe its functions and macroscopic properties
* Identify the intermolecular forces of a designed material based on the molecular structure to describe its function and macroscopic properties
* Identify the polarity of molecules in a designed material based on the molecular structure to describe its function and macroscopic properties
* Identify the free movement of electrons in a metal to describe its function and macroscopic properties
* Describe the effects that attractive and repulsive electrical forces between molecules have on the arrangement of the chosen materials
* Describe how electrostatic forces acting on a molecular scale result in contact forces on a macroscopic scale

### Crosscutting Concept Assessment Target(s)

CCC6 Perform a detailed examination of the properties of different materials, the structures of different components, and connections of components to design a new system or function to solve a problem

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides a model of molecular structures of a designed material and a diagram of attractive and repulsive forces:

* Describe the relationship between the arrangement and the forces (8.2.2, PS2.B.8, and CCC6)

Task provides a short passage about the types of interactions of molecules, a model of the molecular structure of a designed material, and a photo that shows the function of the designed material:

* Make a correct connection between molecular structures, the interactions between them, and the designed material (8.2.2, PS2.B.8, and CCC6)

Task provides both an illustration of a scientific experiment that makes the designed material as well as a short passage about the macroscopic properties of the material:

* Explain how the material’s properties make it suitable for use in its designed function (8.2.2, PS2.B.8, and CCC6)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Electrical wires as an example of a metallic structure
* PVC (polyvinyl chloride) that covers an electrical wire
* Flexible but durable materials made from long chained molecules
* Pharmaceuticals that are designed to interact with specific receptors
* Properties of common substances (e.g., sodium chloride as an example of an ionic compound, water and ice, wax, and crystalline materials)

## Common Misconceptions

None listed at this time.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

HS-PS2-6 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/HS-PS2-6 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/HS-PS2-6%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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