

HS-LS1-5 From Molecules to Organisms: Structures and Processes

California Science Test—Item Content Specifications

# HS-LS1-5 From Molecules to Organisms: Structures and Processes

Students who demonstrate understanding can:

Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

[Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [*Assessment Boundary: Assessment does not include specific biochemical steps.*]

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 ModelsModeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.Use a model based on evidence to illustrate the relationships between systems or between components of a system. | LS1.C: Organization for Matter and Energy Flow in Organisms1. The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen.
 | Energy and MatterChanges of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. |

## 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.

2.2 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.

2.2.1 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

#### LS1.C.6

* Describe that photosynthesis transforms light energy into stored chemical energy by converting carbon dioxide and water into sugars and oxygen
* Describe that in chemical reactions including photosynthesis the breaking of bonds requires energy and the forming of bonds releases energy
* Describe that the chemical energy stored in organic compounds produced by photosynthesis is a result of the difference in the total bond energies of the inputs (carbon dioxide and water) and outputs (sugars and oxygen)
* Describe the role of photosynthesis in the transfer of matter and flow of energy between organisms and the environment
* Identify relationships between the components of a model illustrating the process of photosynthesis

### Crosscutting Concept Assessment Target(s)

CCC5 Describe changes of energy and matter in a system in terms of the flow of energy and matter into, out of, and within that system

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides an interactive model and a question or hypothesis about energy and matter in photosynthesis:

* Uses the data or evidence generated by the model to answer the question about the transformations of energy or matter in photosynthesis (2.2.1, LS1.C.6, and CCC5)
* Uses the data or evidence generated by the model to support or refute the hypothesis (2.2.1, LS1.C.6, and CCC5)

Task provides data or evidence from a model of energy and matter in photosynthesis:

* Identifies the relationships among the inputs and outputs of photosynthesis (2.2.1, LS1.C.6, and CCC5)

Task provides a model of energy and matter in photosynthesis:

* Uses the model to explain an aspect of photosynthesis (2.2.2, LS1.C.6, and CCC5)
* Uses the model to make a prediction about photosynthesis (2.2.2, LS1.C.6, and CCC5)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* An interactive model of photosynthesis in which inputs can be varied to generate data
* An energy diagram of the overall reaction of photosynthesis that shows the relative energy levels of reactants and products
* A model showing the transfer of matter between organisms and the environment during photosynthesis
* A graph showing the effects of light intensity and CO2 concentration on relative photosynthesis rate

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Photosynthesis is a one-step process, as represented by the overall chemical equation.
* Matter is created through photosynthesis.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

HS-LS1-5 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/HS-LS1-5 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/HS-LS1-5%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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