

HS-LS1-6 From Molecules to Organisms: Structures and Processes

California Science Test—Item Content Specifications

# HS-LS1-6 From Molecules to Organisms: Structures and Processes

Students who demonstrate understanding can:

Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

[Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations.] [*Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of macromolecules.*]

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 |
| --- | --- | --- |
| Constructing Explanations and Designing SolutionsConstructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students’ own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.  | LS1.C: Organization for Matter and Energy Flow in Organisms7. The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells.8. As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. | 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.

6.1 Ability to construct explanations of phenomena

6.2 Ability to evaluate 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

6.2.1 Ability to evaluate and revise a given explanation based on an accepted scientific theory and/or data provided

6.2.2 Ability to use data to support or refute an explanation of a phenomenon

### Disciplinary Core Idea Assessment Targets

#### LS1.C.7

* Describe that sugar molecules are composed of carbon, hydrogen, and oxygen atoms
* Describe that simple sugars can be assembled into larger molecules
* Describe that the breakdown of sugar molecules provides component atoms for other carbon-based molecules (e.g., amino acids), which in turn can be assembled into even more complex biological molecules (e.g., proteins)

#### LS1.C.8

* Understand that metabolic processes in organisms break down and synthesize molecules necessary to sustain life
* Describe how recombination of atoms in molecules creates new molecules

### Crosscutting Concept Assessment Target(s)

CCC5 Describe changes of energy and matter in a system in terms of energy and matter flows 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 a model showing the chemical structure of various biologically important hydrocarbons:

* Explains the similarities and/or differences between the molecules (6.1.1, LS1.C.7, and CCC5)
* Explains that the molecules are synthesized in living organisms from atoms derived from other molecules (6.1.1, LS1.C.7, and CCC5)

Task provides a description, observations, and/or data about the biosynthesis of complex biological molecules:

* Uses scientific concepts to explain how the evidence supports a conclusion about biosynthesis of more complex molecules from simple ones such as sugars (6.1.2, LS1.C.7, LS1.C.8, and CCC5)
* Uses big ideas to explain matter and energy flow as biosynthesis occurs at different organizational levels in living systems (6.1.2, LS1.C.7, LS1.C.8, and CCC5)

Task provides a model (e.g., a structural formula) or simulation about the synthesis of complex biological molecules:

* Uses the model or data from the simulation in an explanation (6.1.3, LS1.C.7, and CCC5)

Task provides a description, observations, or data about the synthesis of complex biological molecules:

* Selects the model (e.g., structural formula, chemical reaction) that represents the correct explanation (6.1.3, LS1.C.7, and CCC5)

Task provides a flawed explanation with or without supporting data about the biosynthesis of complex biological molecules:

* Identifies the misconception or missing reasoning in the explanation (6.2.1, LS1.C.7, and CCC5)
* Describes what information is needed to clarify the explanation (6.2.1, LS1.C.7, and CCC5)
* Revises the explanation to make it scientifically accurate (6.2.1, LS1.C.7, and CCC5)

Task provides conflicting explanations about the synthesis of complex biological molecules:

* Selects the correct explanation (6.2.2, LS1.C.7, and CCC5)
* Identifies the flaw in the reasoning of the incorrect explanation (6.2.2, LS1.C.7, and CCC5)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Synthesis of macromolecules from glucose
* Synthesis of structural components of the cell from glucose
* Synthesis of energy-storage molecules such as lipids and carbohydrates

## Common Misconceptions

Note that the list in this section is not exhaustive.

* The only use for glucose in the cell is to provide fuel for the mitochondria.
* Animals can break down macromolecules made by plants but can’t make their own.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

HS-LS1-6 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/HS-LS1-6 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/HS-LS1-6%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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