

HS-LS1-7 From Molecules to Organisms: Structures and Processes

 California Science Test—Item Content Specifications

# **HS-LS1-7 From Molecules to Organisms: Structures and Processes**

Students who demonstrate understanding can:

Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

[Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.] [*Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in cellular respiration.*]

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. As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products.
2. As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment.
 | Energy and MatterEnergy cannot be created or destroyed; it only moves between one place and another place, between objects and/or fields, or between systems. |

## 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.8

* Describe that metabolic processes in organisms break down and/or synthesize molecules necessary to sustain life
* Explain that chemical elements are recombined in organisms to produce essential molecules

#### LS1.C.9

* Describe that cellular respiration converts stored chemical energy into a more readily usable form of chemical energy (i.e., ATP) and heat by breaking down food molecules (e.g., sugars, proteins, fats)
* Describe that chemical reactions involve energy transformations
* Describe that the net energy released by cellular respiration is a result of the difference in the total bond energies of the inputs (food molecules and oxygen) and outputs (carbon dioxide and water)
* Describe the role of cellular respiration in providing energy for other metabolic processes that are necessary to sustain life

### Crosscutting Concept Assessment Target(s)

CCC5 Identify that energy cannot be created or destroyed; it only moves between one place and another place, between objects and/or fields, or between systems

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides an incomplete model showing the movement of energy and matter in cellular respiration:

* Completes the model (2.2.1, LS1.C.8, and CCC5)
* Identifies the data or evidence that can be generated by the model to support energy transformations in cellular respiration (2.2.1, LS1.C.8, and CCC5)

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

* Identifies the mechanisms and relationships among the inputs and outputs of cellular respiration (2.2.1, LS1.C.9, and CCC5)

Task provides a hypothesis about energy and matter in cellular respiration and data generated from a model:

* Uses the data or evidence generated by the model to support or refute a hypothesis about energy and matter in cellular respiration (2.2.1, LS1.C.9, and CCC5)

Task provides a model of energy and matter in cellular respiration:

* Uses the model to explain an aspect of cellular respiration (2.2.2, LS1.C.9, and CCC5)
* Uses the model to make a prediction about cellular respiration (2.2.2, LS1.C.9, and CCC5)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Release of heat energy and waste products
* Transfer of energy during chemical reactions
* Input of oxygen and food molecules
* Release of thermal energy needed to maintain body temperature as connected to chemical processes

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Only animals undergo cellular respiration.
* Plants undergo cellular respiration only at night.
* Breaking bonds (in glucose) releases energy, and forming bonds (in carbon dioxide) requires energy.
* Energy is created during cellular respiration.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

HS-LS1-7 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/HS-LS1-7 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/HS-LS1-7%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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