

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

California Science Test—Item Content Specifications

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

Students who demonstrate understanding can:

Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

[Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [*Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.*]

| Science and Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
| --- | --- | --- |
| Developing and Using Models  Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.  Develop a model to describe unobservable mechanisms. | LS1.C: Organization for Matter and Energy Flow in Organisms  5. Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy.  PS3.D: Energy in Chemical Processes and Everyday Life  4. Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials.*(secondary to MS-LS1-7)* | Energy and Matter  Matter is conserved because atoms are conserved in physical and chemical processes. |

## 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.

2.1 Ability to develop 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.

2.1.1 Ability to determine components of a scientific event, system, or design solution

2.1.2 Ability to determine the relationships among multiple components of a scientific event, system, or design solution

2.1.3 Ability to determine scope, scale, and grain-size of models, as appropriate for their intended use

2.1.4 Ability to represent mechanisms, relationships, and connections to illustrate, explain, or predict a scientific event

### Disciplinary Core Idea Assessment Targets

#### LS1.C.5

* Describe the conservation of matter during food digestion in an organism
* Describe how energy is released when food molecules are broken down
* Describe the number of each type of atom before and after chemical reactions, indicating that the matter ingested as food is conserved as it moves through an organism

#### PS3.D.4

* Develop a model to identify the relevant components (including carbon-containing molecules, oxygen, energy, and new types of molecules formed) in describing how food molecules are broken down and new molecules are synthesized as matter moves through an organism
* Identify and describe the relationships between components of cellular respiration
* Describe how food molecules taken in by the organism are broken down and can then be rearranged to become different molecules in the organism (e.g., proteins, carbohydrates, etc.)

### Crosscutting Concept Assessment Target(s)

CCC5 Identify that matter is conserved because atoms are conserved in physical and chemical processes

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides a summary equation for cellular respiration:

* Identifies the number of atoms before and after the chemical reaction (2.1.1, LS1.C.5, and CCC5)
* Describes relationships between the components to illustrate the conservation of matter (2.1.1, LS1.C.5, and CCC5)
* Describes the change(s) in energy during the chemical reaction as food molecules are broken down (2.1.1, LS1.C.5, and CCC5)

Task provides an incomplete model of the process of cellular respiration:

* Completes the model to illustrate the process of cellular respiration (2.1.1, LS1.C.5, and CCC5)

Task provides a representation of the process of cellular respiration in an organism:

* Uses the representation to indicate that the individual atoms of existing molecules are rearranged to form new molecules in an organism (2.1.2, LS1.C.5, and CCC5)
* Uses labels to represent mechanisms, which are often complex and difficult to observe directly, underlying the process of cellular respiration (2.1.3, LS1.C.5, PS3.D.4, and CCC5)
* Uses the representation to describe how food molecules are taken in by an organism and broken down and how the components are rearranged (2.1.3, LS1.C.5, PS3.D.4, and CCC5)
* Uses the representation to describe how new molecules are used in an organism (2.1.3, LS1.C.5, PS3.D.4, and CCC5)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* A model illustrating how energy is released for cellular work
* The role of oxygen in cellular respiration
* A model illustrating the breakdown of carbon-containing molecules during cellular respiration and the construction of new molecules in organisms from the component parts
* Use of products of digestion to produce polymers

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Energy is created during the process of cellular respiration.
* Cellular respiration is different in plants and animals.
* Plant cells do not undergo cellular respiration, only photosynthesis.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

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