

HS-LS1-4 From Molecules to Organisms: Structures and Processes

California Science Test—Item Content Specifications

# HS-LS1-4 From Molecules to Organisms: Structures and Processes

Students who demonstrate understanding can:

Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

[*Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.*]

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 Models Modeling 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.B: Growth and Development of Organisms 7. In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. | Systems and System Models Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions — including energy, matter, and information flows — within and between systems at different scales. |

## 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

2.3 Ability to evaluate and revise 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

2.3.1 Ability to evaluate models, taking into account additional evidence or aspects of a phenomenon

### Disciplinary Core Idea Assessment Targets

#### LS1.B.7

* Recognize that mitosis is necessary for the growth of a multicellular organism
* Describe that a fertilized egg obtains one member of each chromosome pair from each parent
* Describe that mitosis results in two diploid daughter cells with identical genetic material
* Attribute differences in various cells within a multicellular organism to differences in gene expression rather than different genetic material
* Describe the process of cellular differentiation via variable gene expression and describe the role differentiation plays in maintaining body systems
* Attribute maintenance of body systems and organs to cell division that acts to replace dying cells
* Recognize that mitosis can serve as a form of reproduction in some organisms

### Crosscutting Concept Assessment Target(s)

CCC4 Use models to represent systems and their interactions—including energy, matter, and information flows— within systems at different scales

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides a model representing mitosis and/or cellular differentiation producing cells and tissues or maintaining the functioning of existing body systems:

* Identifies the concepts and relationships represented by the model (2.2.1, LS1.B.7, and CCC4)
* Identifies evidence from the model for the relationships among different components of the cells and tissues or a body system (2.2.1, LS1.B.7, and CCC4)

Task provides a model representing the process of mitosis and/or cellular differentiation:

* Selects or generates an explanation using the model for how the cellular process represented acts to maintain the functioning of existing body systems (2.2.2, LS1.B.7, and CCC4)
* Predicts the outcome of the process represented given the need to maintain the proper functioning of existing body systems (2.2.2, LS1.B.7, and CCC4)

Task provides a model in need of refinement that attempts to represent mitosis and/or cellular differentiation:

* Critiques the provided model to correctly identify its limitations in explaining the production or maintenance of body systems (2.3.1, LS1.B.7, and CCC4)

Task provides a model in need of refinement that attempts to represent mitosis and/or cellular differentiation. Task also provides evidence about an actual mitotic process:

* Critiques the explanatory power of the model by comparing the model to the evidence provided (2.3.1, LS1.B.7, and CCC4)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Growth (from a fertilized egg or of a specific part of a body system)
* Development of a body system via cell differentiation
* Tissue repair or regeneration, mediated by mitosis or cell differentiation
* Blood cell formation from other cells in the bone marrow

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Sister chromatids and homologous chromosomes are interchangeable terms.
* Mitosis and meiosis are interchangeable.
* Organisms grow larger because their cells increase in size.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

HS-LS1-4 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/HS-LS1-4 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/HS-LS1-4%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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