

HS-LS1-3 From Molecules to Organisms: Structures and Processes

California Science Test—Item Content Specifications

# HS-LS1-3 From Molecules to Organisms: Structures and Processes

Students who demonstrate understanding can:

Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

[Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.] [*Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.*]

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 |
| --- | --- | --- |
| Planning and Carrying Out Investigations Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.  Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.  Connections to Nature of Science Scientific Investigations Use a Variety of Methods Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings. | LS1.A: Structure and Function 9. Feedback mechanisms maintain a living system’s internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. | Stability and Change Feedback (negative or positive) can stabilize or destabilize a 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.

3.1 Ability to clarify the goal of the investigation and identify the evidence needed to address the purpose of the investigation

3.2 Ability to develop, evaluate, and refine a plan for the investigation

3.3 Ability to collect the data for the investigation

### 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.

3.1.1 Ability to describe the purpose of the investigation

3.1.2 Ability to identify relevant independent and dependent variables and to consider possible confounding variables or effects

3.1.3 Ability to describe what and how much data need to be collected to provide sufficient evidence for the purpose of the investigation

3.1.4 Ability to describe how the observations and/or collected data can be used as evidence for the phenomenon under investigation

3.2.1 Ability to decide how to observe and/or measure relevant variables, considering the level of accuracy and precision required and the kinds of instrumentation and techniques best suited to making such measurements

3.2.2 Ability to describe a detailed experimental procedure (e.g., number of trials, identify the control) and experimental setup

3.2.3 Ability to compare and evaluate alternative methods to determine which design provides the evidence necessary to address the purpose of the investigation

3.3.1 Ability to use appropriate tools for accurate and precise measurements

3.3.2 Ability to make observations according to the investigation plan

3.3.3 Ability to evaluate the quality of data to determine if the evidence meets the goals of the investigation

### Disciplinary Core Idea Assessment Targets

#### LS1.A.9

* Identify feedback mechanisms and their effects on living systems
* Describe the evidence needed to document the effect of feedback mechanisms on living system
* Develop an investigation plan (including how environmental changes and the living system’s response to them will be measured) to demonstrate the effect of feedback mechanisms on living systems
* Implement a data collection strategy to provide evidence that feedback mechanisms maintain homeostasis
* Evaluate an investigation into feedback mechanisms that maintain homeostasis including an assessment of accuracy and precision of data, limitation, and ability to provide the evidence required to draw conclusions

### Crosscutting Concept Assessment Target(s)

CCC7 Identify feedback, both positive and negative, that can stabilize or destabilize a system

## Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides student with a list of materials or tools for planning an investigation based on feedback mechanisms:

* Identifies or describes a feedback mechanism that can be investigated with the provided list of materials or tools (3.1.1, LS1.A.9, and CCC7)
* Formulates a testable question based on the selected feedback mechanism (3.1.1, LS1.A.9, and CCC7)
* Describes the data that would need to be collected as evidence to address the purpose of the investigation (3.1.1, LS1.A.9, and CCC7)

Task provides student with an experimental question based on how living things maintain homeostasis via feedback loops:

* Identifies factors that might affect the result of the investigation (3.1.2, LS1.A.9, and CCC7)
* Identifies the dependent and independent variables (3.1.2, LS1.A.9, and CCC7)
* Describes experimental procedures appropriate for the target feedback mechanism under investigation using tools or instruments commonly available in a high school laboratory (3.2.2, LS1.A.9, and CCC7)

Task provides student with an experimental protocol for measuring homeostatic response based on feedback mechanisms:

* Identifies what is to be recorded as useful data (3.1.3, LS1.A.9, and CCC7)
* Decides how relevant variables will be measured and collects data for analysis (3.1.3, LS1.A.9, and CCC7)

Task provides student with data from a simulation of an experimental investigation of homeostasis based on feedback mechanisms:

* Evaluates the quality of data to determine if the evidence meets the goal of the investigation (3.1.4, LS1.A.9, and CCC7)
* Develops a procedure with explicit scientific rationales to support the goal of the investigation (3.1.4, LS1.A.9, and CCC7)
* Identifies which trials of data from a simulation can be used as evidence for the goal of the investigation (3.1.4, LS1.A.9, and CCC7)

Task provides student with a list of materials or tools for planning an investigation based on feedback mechanisms:

* Evaluates a provided list of materials or tools for an investigation and identifies gaps (3.1.2, LS1.A.9, and CCC7)
* Selects relevant measuring tools and instrumentations that can help obtain sufficient and precise data (3.1.2, LS1.A.9, and CCC7)

Task provides student with alternative experimental protocols for measuring homeostatic response based on feedback mechanisms:

* Compares and evaluates alternative methods to determine which design provides the evidence necessary to address the purpose of the investigation (3.2.3, LS1.A.9, and CCC7)

Task provides a lab simulation in conjunction with an experimental procedure for investigating homeostasis based on feedback mechanisms:

* Uses tools and techniques to collect data useful for investigating the feedback mechanism (3.3.1, LS1.A.9, and CCC7)

Task provides a video or simulated model of an investigation of homeostasis based on feedback mechanisms:

* Describes and identifies observations relevant to the feedback mechanism under investigation from the video or simulated model (3.3.2, LS1.A.9, and CCC7)
* Uses the observations to evaluate the investigation plan and identify gaps (3.3.2, LS1.A.9, and CCC7)

Task provides student with data from an investigation into the role of a feedback mechanism in maintaining homeostasis:

* Evaluates the quality of data to determine if the evidence meets the goal of the investigation (3.3.3, LS1.A.9, and CCC7)
* Evaluates if the data provided is sufficient to answer the scientific question about the feedback mechanism under investigation (3.3.3, LS1.A.9, and CCC7)

## Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

* Thermoregulation of endotherms
* Effect of exercise on heart rate or breathing rate
* Stomata response to moisture or temperature
* Root development in response to water levels
* Plant growth in response to changing light conditions

## Common Misconceptions

Note that the list in this section is not exhaustive.

* Animals, but not plants, need to maintain homeostasis to survive.
* Living things cannot maintain constant internal conditions when external conditions change.
* When organisms experience changes in their external environment, they die.
* Negative feedback is always bad for organisms, while positive feedback is always good.

## Additional Assessment Boundaries

None listed at this time.

## Additional References

HS-LS1-3 Evidence Statement [https://www.nextgenscience.org/sites/default/files/evidence\_statement/black\_white/HS-LS1-3 Evidence Statements June 2015 asterisks.pdf](https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/HS-LS1-3%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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