

3-LS4-2 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

[Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.]

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems. Use evidence (e.g., observations, patterns) to construct an explanation.	LS4.B: Natural Selection 1. Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.	Cause and Effect Cause and effect relationships are routinely identified and used to explain change.

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

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 a quantitative and/or qualitative explanation of observed relationships
- 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

Disciplinary Core Idea Assessment Targets

- LS4.B.1a Identify that variations in characteristics exist between individuals of the same species
- LS4.B.1b Identify that individuals of a species with a beneficial variation of a trait may have an advantage over other individuals for survival
- LS4.B.1c Identify that individuals of a species with a beneficial variation of a trait may have a reproductive advantage

Crosscutting Concept Assessment Target(s)

- CCC2 Identify cause and effect relationships, using them to explain change

Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides a data set or graphical display showing character variation in a species/population:

- Constructs an explanation based on the data about character variation within the group (6.1.1, LS4.B.1, and CCC2)

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Task provides a data set or graphical display showing character variation in a species/population:

- Describes an advantage that character variation may confer on an individual (6.1.2, LS4.B.1, and CCC2)
- Describes an advantage that character variation may confer on a species (6.1.2, LS4.B.1, and CCC2)

Task provides a model of character variation in a species/population:

- Uses a model or representation to explain the advantages/disadvantages of variation on individual survival and reproduction (6.1.3, LS4.B.1, and CCC2)
- Uses a model or representation to explain the cause-and-effect relationship between the variation and the environment (6.1.3, LS4.B.1, and CCC2)

Environmental Principles and Concepts

- EP2: The long-term functioning and health of terrestrial, freshwater, coastal and marine ecosystems are influenced by their relationships with human societies.

Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

- Within a species, there is variation in characteristics or traits.
- Some variants are better suited to a given environment and increase the likelihood of an individual's survival.
- Individuals with some variants are more likely to survive/find mates/reproduce.
- Variation is important for species survival.
- Variation can be genetic or environmental, but must be genetic to be inherited.
- A change in environment can lead to a change in which variants are better suited to survive and reproduce.

Common Misconceptions

Note that the list in this section is not exhaustive.

- New traits arise because they are required for survival.

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California Science Test—Item Specifications

- Sudden environmental change is required for evolution.
- New traits are always beneficial to an organism.
- Only beneficial traits are passed on.

Additional Assessment Boundaries

None listed at this time.

Additional References

3-LS4-2 Evidence Statement https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/3-LS4-2%20Evidence%20Statements%20June%202015%20asterisks.pdf

Environmental Principles and Concepts <http://californiaeei.org/abouteei/epc/>

California Education and the Environment Initiative <http://californiaeei.org/>

The 2016 Science Framework for California Public Schools Kindergarten through Grade 12

Appendix 1: Progression of the Science and Engineering Practices, Disciplinary Core Core Ideas, and Crosscutting Concepts in Kindergarten through Grade 12

<https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix1.pdf>

Appendix 2: Connections to Environmental Principles and Concepts

<https://www.cde.ca.gov/ci/sc/cf/documents/scifwappendix2.pdf>

5-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

Students who demonstrate understanding can:

Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

[Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.]

Continue to the next page for the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts.

5-LS2-1 Ecosystems: Interactions, Energy, and Dynamics
California Science Test—Item Specifications

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 models and progresses to building and revising simple models and using models to represent events and design solutions. - Develop a model to describe phenomena. Connections to the Nature of Science Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena - Science explanations describe the mechanisms for natural events.	LS2.A: Interdependent Relationships in Ecosystems 3. The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as “decomposers.” Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. LS2.B: Cycles of Matter and Energy Transfer in Ecosystems 1. Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment.	Systems and System Models A system can be described in terms of its components and their interactions.

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 the components as well as relationships among multiple components, to include or omit, of a scientific event, system, or design solution
- 2.1.3 Ability to represent mechanisms, relationships, and connections to illustrate, explain or predict a scientific event

Disciplinary Core Idea Assessment Targets

- LS2.A.3a Trace energy flow and biomass transfer in a food web from plants to animals to decomposers
- LS2.A.3b Identify nutrients required to support plant life
- LS2.A.3c Identify the role of decomposers as organisms that recycle the nutrients stored in animals/plants back into the environment (usually into the soil)
- LS2.A.3d Describe the interconnected relationships between organisms in a food web
- LS2.A.3e Model the flow of energy and the transfer of biomass between organisms in a food web
- LS2.B.1a Identify how matter cycles between the atmosphere, living things, and soil
- LS2.B.1b Describe how newly introduced organisms affect the cycling of matter/flow of energy among the original plants, animals, decomposers in the ecosystem

- LS2.B.1c Describe how changes in a previously stable environment affect the matter flow/energy cycle among the original plants, animals, decomposers in the system

Crosscutting Concept Assessment Target(s)

- CCC4 Describe a system in terms of its components and their interactions

Examples of Integration of Assessment Targets and Evidence

Note that the list in this section is not exhaustive.

Task provides a model of a food web:

- Identifies the producers/consumers/decomposers in the ecosystem (2.1.1, LS2.A.3, and CCC4)
- Describes the role of producers in the ecosystem (2.1.1, LS2.A.3, and CCC4)
- Describes the flow of energy from one trophic level to another within the food web (2.1.1, LS2.A.3, and CCC4)
- Describes the cycling of matter in the food web (2.1.1, LS2.A.3, and CCC4)
- Completes the model (2.1.1, LS2.A.3, and CCC4)
- Identifies evidence for relationships represented among different components of the food web (2.1.3, LS2.A.3, and CCC4)

Task provides a model of a food web with a newly introduced species:

- Interprets model to predict impact of introduction of new species (2.1.1, LS2.B.1, and CCC4)
- Selects the explanation/prediction the provided model is trying to convey (2.1.3, LS2.B.1, and CCC4)

Environmental Principles and Concepts

- EP3: Natural systems proceed through cycles that humans depend upon, benefit from, and can alter.
- EP4: The exchange of matter between natural systems and human societies affects the long-term functioning of both.

Possible Phenomena or Contexts

Note that the list in this section is not exhaustive.

- Trophic levels (biomass, energy availability)
- Food web interactions
- Ecosystem responses to abiotic change
- A geochemical cycle
- Food pyramid
- Introduction of a new species

Common Misconceptions

Note listed at this time.

- Soil is the primary source of energy for plants.
- Dead things do not have energy/nutrients and do not have value to an ecosystem.
- Small changes to an ecosystem only have small impacts.

Additional Assessment Boundaries

None listed at this time.

Additional References

5-LS2-1 Evidence Statement https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/5-LS2-1%20Evidence%20Statements%20June%202015%20asterisks.pdf

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