3-LS1-1   From Molecules to Organisms: Structures and Processes

Students who demonstrate understanding can:

3-LS1-1. **Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.** [Clarification Statement: Changes organisms go through during their life form a pattern.] [*Assessment Boundary: Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Develop models to describe phenomena. - ***Connections to Nature of Science*** **Scientific Knowledge is Based on Empirical Evidence** • Science findings are based on recognizing patterns.	**LS1.B: Growth and Development of Organisms** • Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.	**Patterns** • Patterns of change can be used to make predictions.

Observable features of the student performance by the end of the grade:		
1	Components of the model	
	a	Students develop models (e.g., conceptual, physical, drawing) to describe* the phenomenon. In their models, students identify the relevant components of their models including:
		i. Organisms (both plant and animal).
		ii. Birth.
		iii. Growth.
		iv. Reproduction.
		v. Death.
2	Relationships	
	a	In the models, students describe* relationships between components, including:
		i. Organisms are born, grow, and die in a pattern known as a life cycle.
		ii. Different organisms' life cycles can look very different.
		iii. A causal direction of the cycle (e.g., without birth, there is no growth; without reproduction, there are no births).
3	Connections	
	a	Students use the models to describe* that although organisms can display life cycles that look different, they all follow the same pattern.
	b	Students use the models to make predictions related to the phenomenon, based on patterns identified among life cycles (e.g., prediction could include that if there are no births, deaths will continue and eventually there will be no more of that type of organism).

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

Students who demonstrate understanding can:

3-LS2-1.　　Construct an argument that some animals form groups that help members survive.

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). • Construct an argument with evidence, data, and/or a model.	**LS2.D: Social Interactions and Group Behavior** • Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size *(Note: Moved from K–2).*	**Cause and Effect** • Cause and effect relationships are routinely identified and used to explain change.

	Observable features of the student performance by the end of the grade:	
1	Supported claims	
	a	Students make a claim to be supported about a phenomenon. In their claim, students include the idea that some animals form groups and that being a member of that group helps each member survive.
2	Identifying scientific evidence	
	a	Students describe* the given evidence, data, and/or models necessary to support the claim, including:
		i.　Identifying types of animals that form or live in groups of varying sizes.
		ii.　Multiple examples of animals in groups of various sizes:
		1.　Obtaining more food for each individual animal compared to the same type of animal looking for food individually.
		2.　Displaying more success in defending themselves than those same animals acting alone.
		3.　Making faster or better adjustments to harmful changes in their ecosystem than would those same animals acting alone.
3	Evaluating and critiquing evidence	
	a	Students evaluate the evidence to determine its relevance, and whether it supports the claim that being a member of a group has a survival advantage.
	b	Students describe* whether the given evidence is sufficient to support the claim and whether additional evidence is needed.
4	Reasoning and synthesis	
	a	Students use reasoning to construct an argument connecting the evidence, data and/or models to the claim. Students describe* the following reasoning in their argument:
		i.　The causal evidence that being part of a group can have the effect of animals being more successful in obtaining food, defending themselves, and coping with change supports the claim that being a member of a group helps animals survive.
		ii.　The causal evidence that an animal losing its group status can have the effect of the animal obtaining less food, not being able to defend itself, and not being able to cope with change supports the claim that being a member of a group helps animals survive.

3-LS3-1 Heredity: Inheritance and Variation of Traits

Students who demonstrate understanding can:

3-LS3-1. **Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.** [Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [*Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. • Analyze and interpret data to make sense of phenomena using logical reasoning.	**LS3.A: Inheritance of Traits** • Many characteristics of organisms are inherited from their parents. **LS3.B: Variation of Traits** • Different organisms vary in how they look and function because they have different inherited information.	**Patterns** • Similarities and differences in patterns can be used to sort and classify natural phenomena.

		Observable features of the student performance by the end of the grade:
1		Organizing data
	a	Students organize the data (e.g., from students' previous work, grade-appropriate existing datasets) using graphical displays (e.g., table, chart, graph). The organized data include:
		i. Traits of plant and animal parents.
		ii. Traits of plant and animal offspring.
		iii. Variations in similar traits in a grouping of similar organisms.
2		Identifying relationships
	a	Students identify and describe* patterns in the data, including:
		i. Similarities in the traits of a parent and the traits of an offspring (e.g., tall plants typically have tall offspring).
		ii. Similarities in traits among siblings (e.g., siblings often resemble each other).
		iii. Differences in traits in a group of similar organisms (e.g., dogs come in many shapes and sizes, a field of corn plants have plants of different heights).
		iv. Differences in traits of parents and offspring (e.g., offspring do not look exactly like their parents).
		v. Differences in traits among siblings (e.g., kittens from the same mother may not look exactly like their mother).
3		Interpreting data
	a	Students describe* that the pattern of similarities in traits between parents and offspring, and between siblings, provides evidence that traits are inherited.
	b	Students describe* that the pattern of differences in traits between parents and offspring, and between siblings, provides evidence that inherited traits can vary.
	c	Students describe* that the variation in inherited traits results in a pattern of variation in traits in groups of organisms that are of a similar type.

3-LS3-2 Heredity: Inheritance and Variation of Traits

Students who demonstrate understanding can:

3-LS3-2. **Use evidence to support the explanation that traits can be influenced by the environment.** [Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

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 support an explanation.	**LS3.A: Inheritance of Traits** • Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. **LS3.B: Variation of Traits** • The environment also affects the traits that an organism develops.	**Cause and Effect** • Cause and effect relationships are routinely identified and used to explain change.

Observable features of the student performance by the end of the grade:		
1	Articulating the explanation of phenomena	
	a	Students identify the given explanation to be supported, including a statement that relates the phenomenon to a scientific idea, including that many inherited traits can be influenced by the environment.
2	Evidence	
	a	Students describe* the given evidence that supports the explanation, including:
		i. Environmental factors that vary for organisms of the same type (e.g., amount or food, amount of water, amount of exercise an animal gets, chemicals in the water) that may influence organisms' traits.
		ii. Inherited traits that vary between organisms of the same type (e.g., height or weight of a plant or animal, color or quantity of the flowers).
		iii. Observable inherited traits of organisms in varied environmental conditions
3	Reasoning	
	a	Students use reasoning to connect the evidence and support an explanation about environmental influences on inherited traits in organisms. In their chain of reasoning, students describe* a cause-and-effect relationship between a specific causal environmental factor and its effect of a given variation in a trait (e.g., not enough water produces plants that are shorter and have fewer flowers than plants that had more water available).

3-LS4-1 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

3-LS4-1. **Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.** [Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.] [*Assessment Boundary: Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. • Analyze and interpret data to make sense of phenomena using logical reasoning.	**LS4.A: Evidence of Common Ancestry and Diversity** • Some kinds of plants and animals that once lived on Earth are no longer found anywhere. *(Note: moved from K-2)* • Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments.	**Scale, Proportion, and Quantity** • Observable phenomena exist from very short to very long time periods. - - - - - - - - - - - - - - - - - - ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** • Science assumes consistent patterns in natural systems.

	Observable features of the student performance by the end of the grade:	
1	Organizing data	
	a	Students use graphical displays (e.g., table, chart, graph) to organize the given data, including data about:
		i. Fossils of animals (e.g., information on type, size, type of land on which it was found).
		ii. Fossils of plants (e.g., information on type, size, type of land on which it was found).
		iii. The relative ages of fossils (e.g., from a very long time ago).
		iv. Existence of modern counterparts to the fossilized plants and animals and information on where they currently live.
2	Identifying relationships	
	a	Students identify and describe* relationships in the data, including:
		i. That fossils represent plants and animals that lived long ago.
		ii. The relationships between the fossils of organisms and the environments in which they lived (e.g., marine organisms, like fish, must have lived in water environments).
		iii. The relationships between types of fossils (e.g., those of marine animals) and the current environments where similar organisms are found.
		iv. That some fossils represent organisms that lived long ago and have no modern counterparts.
		v. The relationships between fossils of organisms that lived long ago and their modern counterparts.
		vi. The relationships between existing animals and the environments in which they currently live.
3	Interpreting data	
	a	Students describe* that:
		i. Fossils provide evidence of organisms that lived long ago but have become extinct (e.g., dinosaurs, mammoths, other organisms that have no clear modern counterpart).
		ii. Features of fossils provide evidence of organisms that lived long ago and of what types of environments those organisms must have lived in (e.g., fossilized seashells indicate shelled organisms that lived in aquatic environments).

		iii.	By comparing data about where fossils are found and what those environments are like, fossilized plants and animals can be used to provide evidence that some environments look very different now than they did a long time ago (e.g., fossilized seashells found on land that is now dry suggest that the area in which those fossils were found used to be aquatic; tropical plant fossils found in Antarctica, where tropical plants cannot live today, suggests that the area used to be tropical).

3-LS4-2   Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

3-LS4-2. **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.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

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** • 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.

Observable features of the student performance by the end of the grade:		
1	Articulating the explanation of phenomena	
	a	Students articulate a statement that relates the given phenomenon to a scientific idea, including that variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
	b	Students use evidence and reasoning to construct an explanation for the phenomenon.
2	Evidence	
	a	Students describe* the given evidence necessary for the explanation, including:
		i. A given characteristic of a species (e.g., thorns on a plant, camouflage of an animal, the coloration of moths).
		ii. The patterns of variation of a given characteristic among individuals in a species (e.g., longer or shorter thorns on individual plants, dark or light coloration of animals).
		iii. Potential benefits of a given variation of the characteristic (e.g., the light coloration of some moths makes them difficult to see on the bark of a tree).
3	Reasoning	
	a	Students use reasoning to logically connect the evidence to support the explanation for the phenomenon. Students describe* a chain of reasoning that includes:
		i. That certain variations in characteristics make it harder or easier for an animal to survive, find mates, and reproduce (e.g., longer thorns prevent predators more effectively and increase the likelihood of survival; light coloration of some moths provides camouflage in certain environments, making it more likely that they will live long enough to be able to mate and reproduce).
		ii. That the characteristics that make it easier for some organisms to survive, find mates, and reproduce give those organisms an advantage over other organisms of the same species that don't have those traits.
		iii. That there can be a cause-and-effect relationship between a specific variation in a characteristic (e.g., longer thorns, coloration of moths) and its effect on the ability of the individual organism to survive and reproduce (e.g., plants with longer thorns are less likely to be eaten, darker moths are less likely to be seen and eaten on dark trees).

3-LS4-3 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

3-LS4-3. **Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.** [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.]

The performance expectation above was developed using the following elements from the NRC document A Framework for K-12 Science Education:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). • Construct an argument with evidence.	**LS4.C: Adaptation** • For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.	**Cause and Effect** • Cause and effect relationships are routinely identified and used to explain change.

Observable features of the student performance by the end of the grade:		
1	Supported claims	
	a	Students make a claim to be supported about a phenomenon. In their claim, students include the idea that in a particular habitat, some organisms can survive well, some can survive less well, and some cannot survive at all.
2	Identifying scientific evidence	
	a	Students describe* the given evidence necessary for supporting the claim, including:
		i. Characteristics of a given particular environment (e.g., soft earth, trees and shrubs, seasonal flowering plants).
		ii. Characteristics of a particular organism (e.g., plants with long, sharp leaves; rabbit coloration).
		iii. Needs of a particular organism (e.g., shelter from predators, food, water).
3	Evaluating and critiquing evidence	
	a	Students evaluate the evidence to determine:
		i. The characteristics of organisms that might affect survival.
		ii. The similarities and differences in needs among at least three types of organisms.
		iii. How and what features of the habitat meet the needs of each of the organisms (i.e., the degree to which a habitat meets the needs of an organism).
		iv. How and what features of the habitat do not meet the needs of each of the organisms (i.e., the degree to which a habitat does not meet the needs of an organism).
	b	Students evaluate the evidence to determine whether it is relevant to and supports the claim.
	c	Students describe* whether the given evidence is sufficient to support the claim, and whether additional evidence is needed.
4	Reasoning and synthesis	
	a	Students use reasoning to construct an argument, connecting the relevant and appropriate evidence to the claim, including describing* that any particular environment meets different organisms' needs to different degrees due to the characteristics of that environment and the needs of the organisms. Students describe* a chain of reasoning in their argument, including the following cause-and-effect relationships:
		i. If an environment fully meets the needs of an organism, that organism can survive well within that environment.
		ii. If an environment partially meets the needs of an organism, that organism can survive less well (e.g., lower survival rate, increased sickliness, shorter lifespan) than organisms whose needs are met within that environment.

		iii.	If an environment does not meet the needs of the organism, that organism cannot survive within that environment.
		iv.	Together, the evidence suggests a causal relationship within the system between the characteristics of a habitat and the survival of organisms within it.

3-LS4-4 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

3-LS4-4.   **Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.*** [Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] [*Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). • Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.	**LS2.C: Ecosystem Dynamics, Functioning, and Resilience** • When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. *(secondary)* **LS4.D: Biodiversity and Humans** • Populations live in a variety of habitats, and change in those habitats affects the organisms living there.	**Systems and System Models** • A system can be described in terms of its components and their interactions. - - - - - - - - - - - - - - ***Connections to Engineering, Technology, and Applications of Science*** **Interdependence of Engineering, Technology, and Science on Society and the Natural World** • Knowledge of relevant scientific concepts and research findings is important in engineering.

Observable features of the student performance by the end of the grade:		
1	Supported claims	
	a	Students make a claim about the merit of a given solution to a problem that is caused when the environment changes, which results in changes in the types of plants and animals that live there.
2	Identifying scientific evidence	
	a	Students describe* the given evidence about how the solution meets the given criteria and constraints. This evidence includes:
		i. A system of plants, animals, and a given environment within which they live before the given environmental change occurs.
		ii. A given change in the environment.
		iii. How the change in the given environment causes a problem for the existing plants and animals living within that area.
		iv. The effect of the solution on the plants and animals within the environment.
		v. The resulting changes to plants and animals living within that changed environment, after the solution has been implemented.
3	Evaluating and critiquing evidence	
	a	Students evaluate the solution to the problem to determine the merit of the solution. Students describe* how well the proposed solution meets the given criteria and constraints to reduce the impact of the problem created by the environmental change in the system, including:
		i. How well the proposed solution meets the given criteria and constraints to reduce the impact of the problem created by the environmental change in the system, including:
		1. How the solution makes changes to one part (e.g., a feature of the environment) of the system, affecting the other parts of the system (e.g., plants and animals).
		2. How the solution affects plants and animals.

	b	Students evaluate the evidence to determine whether it is relevant to and supports the claim.
	c	Students describe* whether the given evidence is sufficient to support the claim, and whether additional evidence is needed.