About the *Rhode Island K-12 Grade Span Expectations in Science*

The document, the *Rhode Island K-12 Grade Span Expectations in Science,* has been developed as a means to identify the science concepts and skills expected of all students. The RI science GSEs encompass the content eligible for inclusion on the large-scale assessment of science in grades 4, 8, and 11. They are not intended to represent the full science curriculum at each grade span, but are meant to capture the "major ideas" of science that can be assessed in an on-demand setting. The goal is that the science GSEs focus the curriculum, but do not restrict it.

The science GSEs are written for grade spans K-2, 3-4, 5-6, 7-8, and high school. They describe the science knowledge and abilities students should demonstrate at the end of each grade span. Since the large-scale high school science assessment is given near the end of grade 11, the GSEs for high school for all students are aligned with the content for the assessment. GSEs labeled "**Example Extensions"** are more challenging and provide direction for in-depth study of a particular topic in a course, class or individual student project. The RI science GSEs are extracted from the assessment targets developed as part of the framework for the common science assessment conducted in New Hampshire, Vermont and Rhode Island.

As you review the *Rhode Island K-12 Grade Span Expectations in Science,* the following information is important to understand, particularly the relationship between the science GSEs and the science assessment targets.

The science GSEs are organized into three **domains; Life Science, Earth and Space Science; and Physical Science.**

1. The three domains are further subdivided into ten **Statements of Enduring Knowledge** (EK) (listed in Table 1) that
    a. are intended to identify the fundamental knowledge/concepts for each domain of science.
    b. cut across grade levels, so that learning is developmental/built upon across grades (although not all aspects of the EK may be addressed at all grade levels)
    c. are of comparable grain size
    d. encompass, as a set, the *essential learning for each domain of science*
    e. imply topics of study (and therefore, lead to focused instruction, as identified in science standards/benchmarks/GSEs)

2. Each **Assessment Target** is linked to one Statement of Enduring Knowledge, as indicated with the target's coding (e.g., LS1 means Life Science and the first EK statement, LS2 means Life Science and the second EK, etc.)

3. Each Assessment Target incorporates one or more **Unifying Themes**, the broader universal principles that integrate the different scientific disciplines. Six Unifying Themes of Science were chosen after an extensive review of the literature and are further described in Table 2.

4. Assessment Targets for high school, middle school, and elementary school were developed by applying the Unifying Themes of science to the Statements of Enduring Knowledge for each of the science domains of Life Science, Earth and Space Science, and Physical Science. **Not every Unifying Theme has an "intersection" with every** Statement of Enduring Knowledge. Development committees used prioritization strategies and field reviews to determine which assessment targets would provide the richest opportunities for large-scale assessment purposes.

TABLE 1 ***Statements of Enduring Knowledge (EK) by Domain***	
Life Science	**LS 1** All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, and species).
	LS 2 Matter cycles and energy flows through an ecosystem.
	LS 3 Groups of organisms show evidence of change over time (structures, behaviors, and biochemistry).
	LS 4 Humans are similar to other species in many ways, and yet are unique among Earth's life forms.
Earth & Space Science	**ESS 1** The Earth and earth materials as we know them today have developed over long periods of time, through continual change processes.
	ESS 2 The earth is part of a solar system, made up of distinct parts that have temporal and spatial interrelationships.
	ESS 3 The origin and evolution of galaxies and the universe demonstrate fundamental principles of physical science across vast distances and time
Physical Science	**PS 1** All living and nonliving things are composed of matter having characteristic properties that distinguish one substance from another *(independent of size or amount of substance)*
	PS 2 Energy is necessary for change to occur in matter. Energy can be stored, transferred and transformed, but cannot be destroyed.
	PS 3 The motion of an object is affected by forces.

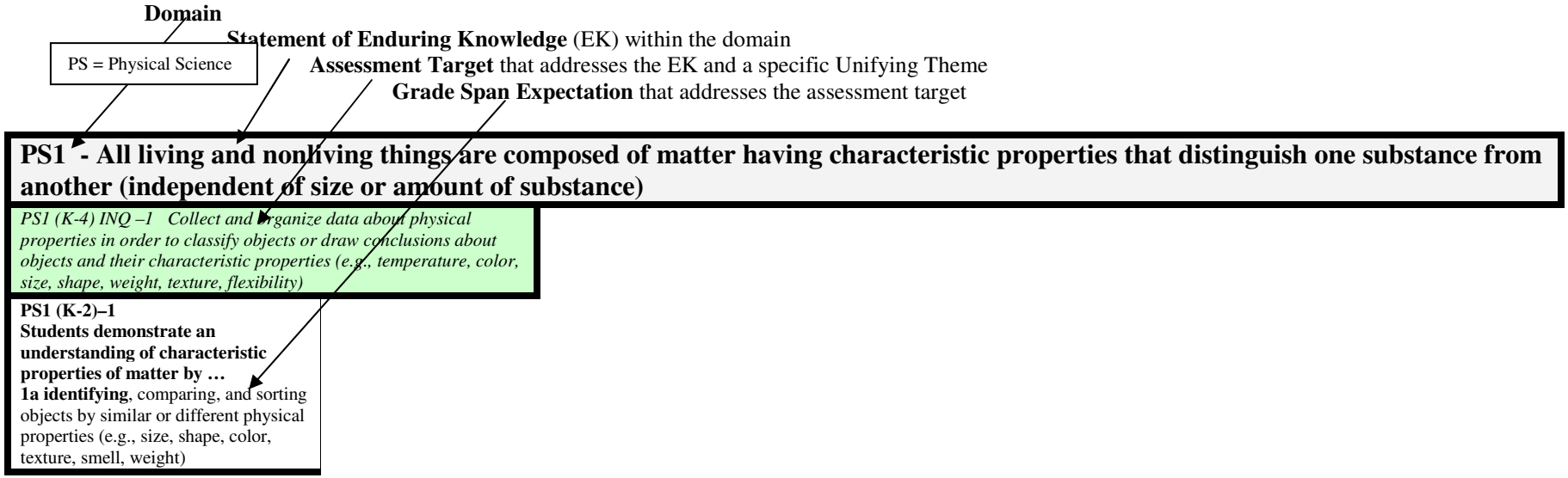
TABLE 2

Unifying Themes of Science

(Subheadings under each Unifying Theme/Big Idea suggest but are not limited to what might be addressed)

Scientific Inquiry	Nature of Science	Systems & Energy	Models & Scale	Patterns of Change	Form & Function
• Collect data • Communicate understanding & ideas • Design, conduct, & critique investigations • Represent, analyze, & interpret data • Experimental design • Observe • Predict • Question and hypothesize • Use evidence to draw conclusions • Use tools, & techniques	• Accumulation of science knowledge (evidence & reasoning, looking at work of others) • Attitudes and dispositions of science (avoiding bias, divergent ideas, healthy skepticism) • History of Science • Science/Tech/ Society • Scientific Theories	• Cycles • Energy Transfer • Equilibrium • Interactions • Interdependence • Order & Organization	• Evidence provided through… • Explanations provided through… • Relative distance • Relative sizes *Models include - experimental models, simulations, & representations used to demonstrate abstract ideas*	• Constancy and Change • Cycles • Evolutionary Change	• Natural World

5. The *Rhode Island K-12 Grade Span Expectations in Science* are sequenced in the following manner:



6. Each Assessment Target contains a code before the narrative text of the target. These codes identify the specific Statement of Enduring Knowledge, the grade span, the connections to one or more Unifying Theme/Big Idea, and finally the target number.

   Table 3 illustrates an example: **LS1 (K-4) INQ+POC –1** means that this target addresses the first Life Science EK statement (**LS1**); the (**K-4**) grade span; is linked to Unifying Themes/Big ideas of Inquiry (**INQ**) and Patterns of Change (**POC**); and is the first assessment target listed (**1**) under the domain of Life Science. Some targets address only one Unifying Theme and others address more than one. For a more detailed explanation see ***READING A SCIENCE GSE*** found on page 6 of this document.

Table 3 Sample Target Coding

LS1 – All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, and species)

Elementary Target	Middle School Target	High School Target
LS1 (K-**4**) **INQ+POC –1** Sort/classify different living things using similar and different characteristics. Describe why organisms belong to each group or cite evidence about how they are alike or not alike.	LS1 (5-**8**) – INQ+ SAE- **1** Using data and observations about the biodiversity of an ecosystem make predictions or draw conclusions about how the diversity contributes to the stability of the ecosystem.	LS1 (9-**11**) INQ+SAE+FAF -**1** Use data and observation to make connections between, to explain, or to justify how specific cell organelles produce/regulate what the cell needs or what a unicellular or multi-cellular organism needs for survival (e.g., protein synthesis, DNA replication, nerve cells)

7. Assessment Target numbering is consecutive within each domain of science for each grade span. For example, at grades K-4, Life Science targets are numbered 1 though 9 (beginning with LS1, then continuing with LS2, LS3, and LS4); Physical Science targets begin the numbering again with 1 through 8 for PS1, PS2 and PS3; and Earth/Space Science targets again begin numbering 1 through 6

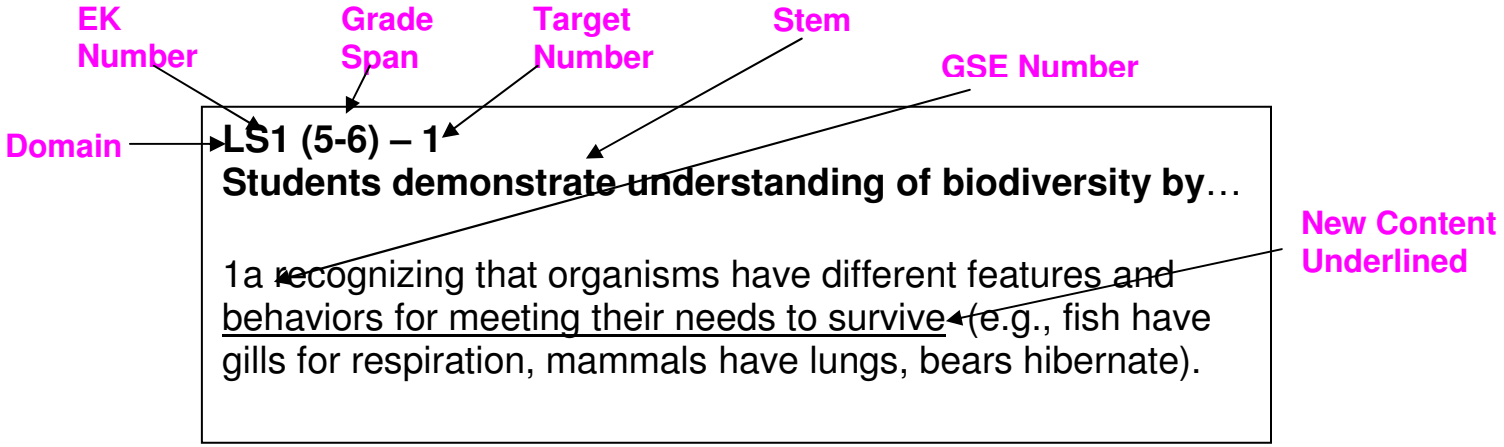
8. While the Statements of Enduring Knowledge are the same across all grade spans, the set of related targets within a grade span *do not address all aspects of the EK Statement.* This was done intentionally to focus instruction and assessment on the essential learning for the grade span, as well as on the developmentally appropriate concepts and skills. For example, at the elementary grade span, LS1 will focus on organisms and external structures, while the middle school grade span will move to internal structures and include organisms and population

The Tri-State Science Assessment Targets are…

- derived from and aligned with national and NH, RI, and VT's state science standards
- developed at the "intersections" by applying the Unifying Themes to the Statements of Enduring Knowledge [e.g., What "Systems & Energy" concepts are essential to understanding LS1: All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, and species)?]
- constructed with the understanding that not every Unifying Theme will have a meaningful "intersection" with every Statement of Enduring Knowledge
- designed to be general/broad enough to allow for multiple potential test items or assessment tasks with varying cognitive demands (Depth of Knowledge Levels)
- written, for the most part, with an intended cognitive demand ceiling consistent with Depth of Knowledge (DOK) Levels 2 (Skills & Concepts) or 3 (Strategic Thinking) – based on the work of Norman L. Webb

READING A SCIENCE GSE

Statement of Enduring Knowledge	Target
LS1 ***All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, and species).***	**LS1 (5-8) – INQ + SAE- 1 Using data and observations about the biodiversity of an ecosystem make predictions or draw conclusions about how the diversity contributes to the stability of the ecosystem.**



LS1 - All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).

LS1 (K-4) - INQ+POC –1		*LS1 (5-8) – INQ+ SAE- 1*		*LS1 (9-11) INQ+SAE+FAF -1*	
Sort/classify different living things using similar and different characteristics. Describe why organisms belong to each group or cite evidence about how they are alike or not alike.		*Using data and observations about the biodiversity of an ecosystem make predictions or draw conclusions about how the diversity contributes to the stability of the ecosystem.*		*Use data and observation to make connections between, to explain, or to justify how specific cell organelles produce/regulate what the cell needs or what a unicellular or multi-cellular organism needs for survival (e.g., protein synthesis, DNA replication, nerve cells).*	
Grade Span Expectations (K-4)		**Grade Span Expectations (5-8)**		**Grade Span Expectations (HS)**	
LS1 (K-2) –1 **Students demonstrate an understanding of classification of organisms by …** **1a** distinguishing between living and non-living things. **1b** identifying and sorting based on a similar or different external features. **lc** observing and recording the external features that make up living things (e.g. roots, stems, leaves, flowers, legs, antennae, tail, shell).	**LS1 (3-4) –1** **Students demonstrate an understanding of classification of organisms by …** **1a** citing evidence to distinguish between living and non-living things. **1b** identifying, sorting and comparing based on similar and/or different external features. **1c** recording and analyzing observations/data about external features (e.g., within a grouping, which characteristics are the same and which are different). **1d** citing evidence (e.g., prior knowledge, data) to draw conclusions explaining why organisms are grouped/not grouped together (e.g. mammal, bird, and fish).	**LS1 (5-6) – 1** **Students demonstrate understanding of biodiversity by…** **1a** recognizing that organisms have different features and behaviors for meeting their needs to survive (e.g., fish have gills for respiration, mammals have lungs, bears hibernate).	**LS1 (7-8) – 1** **Students demonstrate understanding of biodiversity by…** **1a** giving examples of adaptations or behaviors that are specific to a niche (role) within an ecosystem. **1b** explaining how organisms with different structures and behaviors have roles that contribute to each other's survival and the stability of the ecosystem.	**LS1 (9-11)-1** **Students demonstrate understanding of structure and function-survival requirements by**… **1a** explaining the relationships between and amongst the specialized structures of the cell and their functions (e.g. transport of materials, energy transfer, protein building, waste disposal, information feedback, and even movement). **1b** explaining that most multicellular organisms have specialized cells to survive, while unicellular organisms perform all survival functions. (e.g. nerve cells communicate with other cells, muscle cells contract, unicellular are not specialized). **Students demonstrate understanding of differentiation by…** **1c** comparing the role of various sub-cellular structures in unicellular organisms to comparable structures in multicellular organisms (e.g. oral groove, gullet, food vacuole in Paramecium compared to digestive systems in multicellular organisms).	**Example Extension(s)** **LS1 (Ext)-1** **Students demonstrate understanding of structure and function-survival requirements by** **1aa** describing how the malfunction of cell organelles can lead to disease (e.g. "leaky" lysosomes and rheumatoid arthritis) **1bb** identify various specialized cells and common unicellular organisms in diagrams, photographs and/or microscopic slides. **Students demonstrate understanding of differentiation by…** **1cc** describing the origin and nature of stem cells and their potential for curing disease.

LS1 - All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).

LS1 (K-4) SAE -2	*LS1 (5-8) SAE+FAF –2*	*LS1 (9-11) FAF+ POC -2*
Identify the basic needs of plants and animals in order to stay alive. (i.e., water, air, food, space).	*Describe or compare how different organisms have mechanisms that work in a coordinated way to obtain energy, grow, move, respond, provide defense, enable reproduction, or maintain internal balance (e.g., cells, tissues, organs and systems).*	*Explain or justify with evidence how the alteration of the DNA sequence may produce new gene combinations that make little difference, enhance capabilities, or can be harmful to the organism (e.g., selective breeding, genetic engineering, mutations).*

Grade Span Expectations (K-4)		Grade Span Expectations (5-8)		Grade Span Expectations (HS)	
LS1 (K-2)-2 **Students demonstrate understanding of structure and function-survival requirements by…** **2a** observing that plants need water, air, food, and light to grow; observing that animals need water, air, food and shelter to grow.	**LS1 (3-4)-2** **Students demonstrate understanding of structure and function-survival requirements by…** **2a** observing that plants need water, air, food, light and space to grow and reproduce; observing that animals need water, air, food, and shelter/space to grow and reproduce.	**LS1 (5-6) – 2** **Students demonstrate understanding of structure and function-survival requirements by…** **2a** describing structures or behaviors that help organisms survive in their environment (e.g., defense, obtaining nutrients, reproduction, and eliminating waste).	**LS1 (7-8) – 2** **Students demonstrate understanding of structure and function-survival requirements by…** **2a** explaining how the cell, as the basic unit of life, has the same survival needs as an organism (i.e., obtain energy, grow, eliminate waste, reproduce, provide for defense). **2b** observing and describing (e.g., drawing, labeling) individual cells as seen through a microscope targeting cell membrane, cell wall, nucleus, and chloroplasts. **2c** observing, describing and charting the growth, motion, responses of living organisms	**LS1 (9-11) –2** **Students demonstrate an understanding of the molecular basis for heredity by …** **2a** describing the DNA structure and relating the DNA sequence to the genetic code. **2b** explaining how DNA may be altered and how this affects genes/heredity (e.g. substitution, insertion, or deletion). **2c** describing how DNA contains the code for the production of specific proteins.	**Example Extension(s)** **LS1 (Ext) –2** **Students demonstrate an understanding of the molecular basis for heredity by …** **2aa** diagramming or modeling the relationship between chromosomes, genes and DNA, including histones and nucleosomes. **2bb** describing the how foods are genetically modified and the potential health, environmental and economic advantages and disadvantages of doing so. **2cc** tracing in a diagram or model the information flow - DNA to RNA to Protein - through transcription and translation.

LS1 - All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).

LS1 (K-4) POC –3 *Predict, sequence or compare the life stages of organisms – plants and animals (e.g., put images of life stages of an organism in order, predict the next stage in sequence, compare two organisms*).		*LS1 (5-8) POC -3* *Compare and contrast sexual reproduction with asexual reproduction.*		**No further targets for EK LS1 at the High School Grade Span**	
Grade Span Expectations (K-4)		**Grade Span Expectations (5-8)**		**Grade Span Expectations (HS)**	
LS1 (K-2)–3 **Students demonstrate an understanding of reproduction by …** **3a** observing and scientifically drawing (e.g. recording shapes, prominent features, relative proportions, organizes and differentiates significant parts observed) and labeling the stages in the life cycle of a familiar plant and animal. **3b** sequencing the life cycle of a plant or animal when given a set of pictures.	**LS1 (3-4)–3** **Students demonstrate an understanding of reproduction by …** **3a** observing changes and recording data to scientifically draw and label the stages in the life cycle of a familiar plant and animal. **3b** sequencing the life cycle of a plant or animal when given a set of data/pictures. **3c** comparing the life cycles of 2 plants or 2 animals when given a set of data/pictures.	**LS1 (5-6) –3** **Students demonstrate an understanding of reproduction by …** **3a** defining reproduction as a process through which organisms produce offspring. **3b** describing reproduction in terms of being essential for the continuation of a species. **3c** investigating and comparing a variety of plant and animal life cycles.	**LS1 (7-8)–3** **Students demonstrate an understanding of reproduction by …** **3a** explaining reproduction as a fundamental process by which the new individual receives genetic information from parent(s). **3b** describing forms of asexual reproduction that involve the genetic contribution of only one parent (e.g., binary fission, budding, vegetative propagation, regeneration). **3c** describing sexual reproduction as a process that combines genetic material of two parents to produce a new organism (e.g., sperm/egg, pollen/ova)		

LS1 - All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, & species).					
LS1 (K-4) FAF –4 *Identify and explain how the physical structures of an organism (plants or animals) allow it to survive in its habitat/environment (e.g., roots for water; nose to smell fire).*		***LS1 (5-8) FAF –4*** *Explain relationships between or among the structure and function of the cells, tissues, organs, and organ systems in an organism.*		**No further targets for EK LS1 at the High School Grade Span**	
Grade Span Expectations (K-4)		**Grade Span Expectations (5-8)**		**Grade Span Expectations (HS)**	
LS1 (K-2)–4 **Students demonstrate understanding of structure and function-survival requirements by…** **4a** identifying the specific functions of the physical structures of a plant or an animal (e.g. roots for water; webbed feet for swimming).	**LS1 (3-4)–4** **Students demonstrate understanding of structure and function-survival requirements by…** **4a** identifying and explaining how the physical structure/characteristic of an organism allows it to survive and defend itself (e.g. of a characteristic – the coloring of a fiddler crab allows it to camouflage itself in the sand and grasses of its environment so that it will be protected from predators). **4b** analyzing the structures needed for survival of populations of plants and animals in a particular habitat/environment (e.g. populations of desert plants and animals require structures that enable them to obtain/conserve/ retain water).	**LS1 (5-6) –4** **Students demonstrate understanding of differentiation by…** **4a** identifying cells as the building blocks of organisms. **4b** recognizing and illustrating (e.g. flow chart) the structural organization of an organism from a cell to tissue to organs to organ systems to organisms.	**LS1 (7-8)–4** **Students demonstrate understanding of differentiation by…** **4a** explaining that specialized cells perform specialized functions. (e.g., muscle cells contract, nerve cells transmit impulses, skin cells provide protection). **4b** comparing individual cells of tissues and recognizing the similarities of cells and how they work together to perform specific functions. **4c** explaining how each type of cell, tissue, and organ has a distinct structure and set of functions that serve the organism as a whole.		

LS2 - Matter cycles and energy flows through an ecosystem.

LS2 (K-4) SAE –5 *Recognize that energy is needed for all organisms to stay alive and grow or identify where a plant or animal gets its energy.*		*LS2 (5-8) INQ+SAE -5* *Using data and observations, predict outcomes when abiotic/biotic factors are changed in an ecosystem.*		*LS2 (9-11) INQ+SAE -3* *Using data from a specific ecosystem, explain relationships or make predictions about how environmental disturbance (human impact or natural events) affects the flow of energy or cycling of matter in an ecosystem.*	
Grade Span Expectations (K-4)		**Grade Span Expectations (5-8)**		**Grade Span Expectations (HS)**	
LS2 (K-2)–5 **Students demonstrate an understanding of energy flow in an ecosystem by …** **5a** caring for plants and/or animals by identifying and providing for their needs; experimenting with a plant's growth under different conditions, including light and no light.	**LS2 (3-4) –5** **Students demonstrate an understanding of energy flow in an ecosystem by …** **5a** identifying sources of energy for survival of organisms (i.e. light or food).	**LS2 (5-6) –5** **Students demonstrate an understanding of equilibrium in an ecosystem by …** **5a** identifying and defining an ecosystem and the variety of relationships within it (e.g., predator/prey, consumer/ producer/decomposer, host/parasite, catastrophic events).	**LS2 (7-8) –5** **Students demonstrate an understanding of equilibrium in an ecosystem by …** **5a** identifying which biotic (e.g., bacteria, fungi, plants, animals) and abiotic (e.g., weather, climate, light, water, temperature, soil composition, catastrophic events) factors affect a given ecosystem. **5b** analyzing how biotic and abiotic factors affect a given ecosystem. **5c** predicting the outcome of a given change in biotic and abiotic factors in an ecosystem. **5d** using a visual model (e.g., graph) to track population changes in an ecosystem.	**LS2 (9-11)-3** **Students demonstrate an understanding of equilibrium in an ecosystem by …** **3a** defining and giving an example of equilibrium in an ecosystem. **3b** describing ways in which humans can modify ecosystems and describe and predict the potential impact (e.g. human population growth; technology; destruction of habitats; agriculture; pollution; and atmospheric changes). **3c** describing ways in which natural events (e.g. floods and fires) can modify ecosystems and describe and predict the potential effects.	**Example Extension(s)** **LS2 (Ext)-3** **Students demonstrate an understanding of equilibrium in an ecosystem by …** **3bb** researching and citing evidence of global warming to describe the potential impact on both the living and physical systems on Earth. **3cc** investigating and reporting on a case study of ecosystem disruption caused by a natural event (e.g. Mississippi River delta region and hurricanes).

LS2 - Matter cycles and energy flows through an ecosystem.

LS2 (K-4) SAE –6 *Describe ways plants and animals depend on each other (e.g., shelter, nesting, food).*		*LS2 (5-8) SAE– 6* *Given a scenario trace the flow of energy through an ecosystem, beginning with the sun, through organisms in the food web, and into the environment (includes photosynthesis and respiration).*		*LS2 (9-11) POC+ SAE –4* *Trace the cycling of matter (e.g., carbon cycle) and the flow of energy in a living system from its source through its transformation in cellular, biochemical processes (e.g., photosynthesis, cellular respiration, fermentation).*	
Grade Span Expectations (K-4)		**Grade Span Expectations (5-8)**		**Grade Span Expectations (HS)**	
LS2 (K-2)–6 **Students demonstrate an understanding of food webs in an ecosystem by …** **6a** acting out or constructing simple diagrams (pictures or words) that shows a simple food web. **6b** using information about a simple food web to determine how basic needs (e.g. shelter and water) are met by the habitat/environment.	**LS2 (3-4)–6** **Students demonstrate an understanding of food webs in an ecosystem by …** **6a** demonstrating in a food web that all animals' food begins with the sun. **6b** using information about organisms to design a habitat and explain how the habitat provides for the needs of the organisms that live there **6c** explaining the way that plants and animals in that habitat depend on each other.	**LS2 (5-6) –6** **Students demonstrate an understanding of energy flow in an ecosystem by …** **6a** identifying the sun as the major source of energy for life on earth and sequencing the energy flow in an ecosystem. **6b.** describing the basic processes and recognizing the substances involved in photosynthesis and respiration.	**LS2 (7-8) –6** **Students demonstrate an understanding of energy flow in an ecosystem by …** **6a** explaining the transfer of the sun's energy through living systems and its effect upon them. **6b** describing the basic processes and recognizing the names and chemical formulas of the substances involved in photosynthesis and respiration. **6c** explaining the relationship between photosynthesis and respiration. **Students demonstrate an understanding of food webs in an ecosystem by …** **6d** creating or interpreting a model that traces the flow of energy in a food web.	**LS2 (9-11)–4** **Students demonstrate an understanding of matter and energy flow in an ecosystem by …** **4a** diagramming the energy flow in an ecosystem that compares the energy at different trophic levels. (e.g. What inferences can you make about energy "loss"& use?). **4b** explaining how the chemical elements and compounds that make up living things pass through food webs and are combined and recombined in different ways (e.g. nitrogen, carbon cycles, O_2, & H_2O cycles)**.**	**Example Extension(s)** **LS2 (Ext)–4** **Students demonstrate an understanding of matter and energy flow in an ecosystem by …** **4aa** explaining the energy transfer with cells in photosynthesis and cellular respiration, tracking ATP production and consumption.

LS2 - Matter cycles and energy flows through an ecosystem					
No further targets for EK LS 2 at the K-4 Grade Span		***LS2 (5-8) SAE-7*** *Given an ecosystem, trace how matter cycles among and between organisms and the physical environment (includes water, oxygen, food web, decomposition, recycling but **not** carbon cycle or nitrogen cycle).*		***LS2 (9-11) NOS –5*** *Explain or evaluate potential bias in how evidence is interpreted in reports concerning a particular environmental factor that impacts the biology of humans.*	
Grade Span Expectations (K-4)		**Grade Span Expectations (5-8)**		**Grade Span Expectations (HS)**	
		LS2 (5-6)-7 **Students demonstrate an understanding of recycling in an ecosystem by …** **7a** explaining the processes of precipitation, evaporation, condensation as parts of the water cycle. **7b** completing a basic food web for a given ecosystem.	**LS2 (7-8)-7** **Students demonstrate an understanding of recycling in an ecosystem by …** **7a** diagramming or sequencing a series of steps showing how matter cycles among and between organisms and the physical environment. **7b** developing a model for a food web of local aquatic and local terrestrial environments. **7c** explaining the inverse nature or complementary aspects of photosynthesis/respiration in relation to carbon dioxide, water and oxygen exchange. **7d** conducting a controlled investigation that shows that the total amount of matter remains constant, even though its form and location change as matter is transferred among and between organisms and the physical environment (e.g., bottle biology, mass of a closed system over time).	**LS2 (9-11)–5** **Students will evaluate potential bias from a variety of media sources in how information is interpreted by…** **5a** analyzing claims from evidence and sources and evaluate based upon relevance, and validity. **5b** applying additional scientific data to develop logical arguments concerning environmental issues (e.g. tobacco company vs. cancer society articles on effects of smoking, government/big business vs. environmental perceptions of global climate change).	**Example Extension(s)**

LS3 - Groups of organisms show evidence of change over time (structures, behaviors, and biochemistry).					
LS3 (K-4) SAE –7 *Using information (data or scenario), explain how changes in the environment can cause organisms to respond (e.g., survive there and reproduce, move away, die).*		***LS3 (5-8) MAS+FAF – 8*** *Use a model, classification system, or dichotomous key to illustrate, compare, or interpret possible relationships among groups of organisms (e.g., internal and external structures, anatomical features).*		***LS3 (9-11) NOS -6*** *Explain how evidence from technological advances supports or refutes the genetic relationships among groups of organisms (e.g., DNA analysis, protein analysis.*	
Grade Span Expectations (K-4)		**Grade Span Expectations (5-8)**		**Grade Span Expectations (HS)**	
LS3 (K-2)–7 **Students demonstrate an understanding of equilibrium in an ecosystem by …** **Currently no GSEs for this target at K-2 Grade Span**	**LS3 (3-4) –7** **Students demonstrate an understanding of equilibrium in an ecosystem by …** **7a** explaining what plants or animals might do if their environment changes (e.g., changing food supply or habitat due to fire, human impact, sudden weather-related changes). **7b** explaining how the balance of the ecosystem can be disturbed (e.g., how does overpopulation of a species affect the rest of the ecosystem).	**LS3 (5-6) – 8** **Students demonstrate an understanding of classification of organisms by …** **8a** stating the value of, or reasons for, classification systems. **8b** following a taxonomic key to identify a given organism (e.g. flowering and non-flowering plants).	**LS3 (7-8) – 8** **Students demonstrate an understanding of classification of organisms by …** **8a** sorting organisms with similar characteristics into groups based on internal and external structures. **8b** explaining how species with similar evolutionary histories/characteristics are classified more closely together with some organisms than others (e.g., a fish and human have more common with each other than a fish and jelly fish) **8c** recognizing the classification system used in modern biology.	**LS3 (9-11)-6** **Students will demonstrate their understanding of the degree of genetic relationships among organisms by …** **6a** using given data (diagrams, charts, narratives, etc.) and advances in technology to explain how our understanding of genetic variation has developed over time.	**Example Extension(s)** **LS3 (Ext) -6** **Students will demonstrate their understanding of the degree of genetic relationships among organisms by …** **6aa** describing how the Human Genome Project has contributed to our understanding of both human heredity and the commonality of DNA sequences among organisms.

LS3 - Groups of organisms show evidence of change over time (structures, behaviors, and biochemistry).					
No further targets for EK LS 3 at theK-4 Grade Span		***LS3 (5-8) POC-9*** *Cite examples supporting the concept that certain traits of organisms may provide a survival advantage in a specific environment and therefore, an increased likelihood to produce offspring.*		***LS3 (9-11) INQ POC-7*** *Given a scenario, provide evidence that demonstrates how sexual reproduction results in a great variety of possible gene combinations and contributes to natural selection (e.g., Darwin's finches, isolation of a species, Tay Sach's disease).*	
Grade Span Expectations (K-4)		**Grade Span Expectations (5-8)**		**Grade Span Expectations (HS)**	
		LS3 (5-6) -9 **Students demonstrate an understanding of Natural Selection/evolution by …** **9a** explaining how a population's or species' traits affect their ability to survive over time. **9b** researching or reporting on possible causes for the extinction of an animal or plant. **9c** explaining how fossil evidence can be used to understand the history of life on Earth.	**LS3 (7-8) -9** **Students demonstrate an understanding of Natural Selection/ evolution by …** **9a** explaining that genetic variations/traits of organisms are passed on through reproduction and random genetic changes. **9b** gathering evidence that demonstrates evolutionary relationships among organisms (e.g., similarities in body structure, early development, traits). **9c** differentiating between acquired and inherited characteristics and giving examples of each. **9d** explaining how natural selection leads to evolution (e.g., survival of the fittest). **9e** describing how scientists' understanding of the way species originate or become extinct has changed over time.	**LS3 (9-11) -7** **Students demonstrate an understanding of Natural Selection/ evolution by…** **7a** investigating how information is passed from parents to offspring by encoded molecules (e.g. evidence from electrophoresis, DNA fingerprinting). **7b** investigating how the sorting and recombination of genes in sexual reproduction results in a great variety of possible gene combinations in the offspring of any two parents. (e.g. manipulate models to represent and predict genotypes and phenotypes, Punnett Squares, probability activities). **7c** citing evidence of how natural selection and its evolutionary consequences provide a scientific explanation for the diversity and unity of past and present life forms on Earth. (e.g. Galapagos Islands, Hawaiian Islands, Australia, geographic isolation, adaptive radiation).	**Example Extension(s)** **LS3 (Ext) -7** **Students demonstrate an understanding of Natural Selection/ evolution by…** **7aa** distinguishing the stages of mitosis and meiosis and how each contributes to the production of offspring with varying traits **7bb** researching and reporting on the contributions of key scientist in understanding evolution and natural selection (e .g. Darwin, Wallace, Mendel). **7cc trace** the evolution and migration of **Homo *sapiens.***

LS3 - Groups of organisms show evidence of change over time (structures, behaviors, and biochemistry).

No further targets for EK LS 3 at the K-4 Grade Span	**No further targets for EK LS 2 at the 5-8 Grade Span**	***LS3 (9-11) INQ FAF+POC -8*** *Given information about living or extinct organisms, cite evidence to explain the frequency of inherited characteristics of organisms in a population, OR explain the evolution of varied structures (with defined functions) that affected the organisms' survival in a specific environment (e.g., giraffe, wind pollination of flowers).*	
Grade Span Expectations (K-4)	**Grade Span Expectations (5-8)**	**Grade Span Expectations (HS)**	
		LS3 (9-11) -8 Students demonstrate an understanding of Natural Selection/ evolution by… **8a** illustrating that when an environment changes, the survival advantage /disadvantage of some characteristics may change. **8b** distinguish between microevolution (on small scale within a single population –e.g., change in gene frequency within a population) and macroevolution (on a scale that transcends boundaries of a single species – e.g., diversity of all beetle species within the order of insects) and explain how macroevolution accounts for speciation and extinction. **8c** recognizing patterns in molecular and fossil evidence, to provide a scientific explanation for Natural Selection and its evolutionary consequences (e.g. survival, adaptation). **Students demonstrate an understanding of classification of organisms by …** **8d** using data or models (charts, diagrams, table, narratives etc.) to analyze how organisms are organized into a hierarchy of groups and subgroups based on evolutionary relationships. (e.g. creating a taxonomic key to organize a given set of examples).	**Example Extension(s) Students demonstrate an understanding of Natural Selection/ evolution by…** **8bb** explain punctuated equilibrium as a model of evolution and contrast it with a more gradual model of evolution**.**

LS 4 - Humans are similar to other species in many ways, and yet are unique among Earth's life forms.

LS4 (K-4) FAF -8	*LS4 (5-8) INQ-10*	*LS4 (9-11) NOS+INQ -9*
Identify what the physical structures of humans do (e.g., sense organs – eyes, ears, skin, etc.) or compare physical structures of humans to similar structures of animals.	*Use data and observations to support the concept that environmental or biological factors affect human body systems (biotic & abiotic).*	*Use evidence to make and support conclusions about the ways that humans or other organisms are affected by environmental factors or heredity (e.g., pathogens, diseases, medical advances, pollution, mutations).*

Grade Span Expectations (K-4)		Grade Span Expectations (5-8)		Grade Span Expectations (HS)	
LS4 (K-2)-8 **Students demonstrate an understanding of human body systems by …** **8a** identifying the five senses and using senses to identify objects in the environment, **8b** observing, identifying, and recording external features of humans and other animals. **8c** identifying the senses needed to meet survival needs for a given situation.	**LS4 (3-4)-8** **Students demonstrate an understanding of human body systems by …** **8a** showing connections between external and internal body structures (i.e., organs and systems) and how they help humans survive. **8b** comparing and analyzing external features and characteristics of humans and other animals.	**LS4 (5-6)-10** **Students demonstrate an understanding of human body systems by …** **10a** identifying the biotic factors (e.g., microbes, parasites, food availability, aging process) that have an effect on human body systems. **10b** identifying the abiotic factors (e.g., drugs, altitude, weather, pollution) that have an effect on human body systems. **Students demonstrate an understanding patterns of human health/disease by …** **10c** identifying the biotic (e.g., microbes, parasites, food availability, aging process) and abiotic (e.g., radiation, toxic materials, carcinogens) factors that cause disease and affect human health.	**LS4 (7-8)-10** **Students demonstrate an understanding of human body systems by …** **10a** predicting and explaining the effects of biotic factors (e.g., microbes, parasites, food availability, aging process) on human body systems. **10b** predicting and explaining the effect of abiotic factors (e.g., drugs, environmental conditions) on human body systems. **Students demonstrate an understanding of patterns of human health/disease by …** **10c** researching and reporting on how biotic (e.g., microbes, parasites, food availability, aging process) and abiotic (e.g., radiation, toxic materials, carcinogens) factors cause disease and affect human health.	**LS4 (9-11) –9** **Students demonstrate an understanding of how humans are affected by environmental factors and/or heredity by …** **9a** researching scientific information to explain how such things as radiation, chemicals, and other factors can cause gene mutations or disease. **9b** providing an explanation of how the human species impacts the environment and other organisms (e.g. reducing the amount of the earth's surface available to those other species, interfering with their food sources, changing the temperature and chemical composition of their habitats, introducing foreign species into their ecosystems, and altering organisms directly through selective breeding and genetic engineering).	**Example Extension(s)** **LS4 (Ext) –9** **Students demonstrate an understanding of how humans are affected by environmental factors and/or heredity by …** **9bb** using a computer simulation to study the effects of human activities on a particular environment (actual or model).

LS 4 - Humans are similar to other species in many ways, and yet are unique among Earth's life forms.

LS4 (K-4) POC -9		*LS4 (5-8) INQ+POC-11*		*LS4 (9-11) SAE+FAF -10*	
Distinguish between characteristics of humans that are inherited from parents (i.e., hair color, height, skin color, eye color) and others that are learned (e.g., riding a bike, singing a song, playing a game, reading)		*Using data provided, select evidence that supports the concept that genetic information is passed on from both parents to offspring.*		*Explain how the immune system, endocrine system, or nervous system works and draw conclusions about how systems interact to maintain homeostasis in the human body.*	
Grade Span Expectations (K-4)		**Grade Span Expectations (5-8)**		**Grade Span Expectations (HS)**	
LS4 (K-2) –9 **Students demonstrate an understanding of human heredity by …** **9a** observing and comparing their physical features with those of parents, classmates and other organisms. **9b** identifying that some behaviors are learned.	**LS4 (3-4) –9** **Students demonstrate an understanding of human heredity by …** **9a** identifying similarities that are inherited from a biological parent. **9b** identifying that some behaviors are learned and some behaviors are instinctive.	**LS4 (5-6)-11** **Students demonstrate an understanding of human heredity by …** **11a** differentiating between inherited and acquired traits. **11b** observing, recording and comparing differences in inherited traits (e.g. connected earlobe, tongue rolling).	**LS4 (7-8)-11** **Students demonstrate an understanding of human heredity by …** **11a** recognizing that characteristics of an organism result from inherited traits of one or more genes from the parents and others result from interactions with the environment. **11b** tracing a genetic characteristic through a given pedigree (e.g., genealogical chart, Queen Victoria – hemophilia or hypothetical example) to demonstrate the passage of traits. **11c** identifying that genetic material (i.e. chromosomes and genes) is located in the cell's nucleus.	**LS4 (9-11)-10** **Students demonstrate an understanding of human body systems by …** **10a** explaining how the roles of the immune, endocrine, and nervous systems work together to maintain homeostasis. **10b** investigating the factors that affect homeostasis (e.g. positive and negative feedback).	**Example Extension(s)** **LS4 (Ext)-10** **Students demonstrate an understanding of human body systems by …** **10bb** investigating and reporting on a human disease and its consequential disruption of homeostasis (e.g. diabetes, cancer, AIDS).

<table>
<tr><th colspan="4">LS 4 - Humans are similar to other species in many ways, and yet are unique among Earth's life forms.</th></tr>
<tr><td colspan="2">No further targets for EK LS 4
at the K-4 Grade Span</td><td colspan="1">LS4 (5-8) POC-12
Describe the major changes that occur over time in human development from single cell through embryonic development to new born (i.e., trimesters: 1st – group of cells, 2nd - organs form, 3rd - organs mature.</td><td>No further targets for EK LS 4
at the High School Grade Span</td></tr>
<tr><td colspan="2">Grade Span Expectations (K-4)</td><td colspan="1">Grade Span Expectations (5-8)</td><td>Grade Span Expectations (HS)</td></tr>
<tr><td></td><td></td><td>.</td><td>LS4 (7-8) -12
Students demonstrate an understanding of patterns of human development by…

12a identifying and sequencing the stages of human embryonic development.

12b describing the changes from one stage of embryonic development to the next.

12c comparing and contrasting embryonic development in various life forms (e.g., humans, frogs, chickens, sea urchins).

12d comparing the patterns of human development after birth to life stages of other species.</td><td></td></tr>
<tr><td colspan="2">Total K-4 Targets for LS = 9
Total K-4 GSEs for LS = 33 (K-2 = 13, Grades 3-4 = 20)</td><td colspan="1">Total 5-8 Targets for LS = 12
Total 5-8 GSEs for LS = 63 (Grades 5-6 = 22, Grades 7-8 = 41)</td><td>Total H.S. GSE Targets for LS = 10
Total H.S. GSEs for LS = 42
Total Extension GSEs for LS = 16</td></tr>
</table>