Life Science Framework K-12

(NGSS in Parentheses)

Kindergarten								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
K	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Animals need food (plants and other animals) and water in order to live and grow. (LS1.C)	Use observations to describe what animals need to survive. (K-LS1-1)	Environment Leaves Organism Patterns Roots Stems Structure Survive	3.2,4.B 3.3.4.A 4.6.4.A	3.1.4.A.2	S4 A.2.1.3 S4.B.1.1.1 S4.B.1.1.2 S4.B.1.1.3 S4.B.1.1.4
K	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Plants need water and light in order to live and grow. (LS1.C)	Use observations to describe what plants need to survive. (K-LS1-1)	Cause and effect Leaves Environment Organism Roots Stems Structure Survive	3.2.4.B 3.3.4.A 4.6.4.A	3.1.4.A.2 3.1.3.A.2	S4.B.1.1.1 S4.B.1.1.2 S4.B.1.1.3 S4.B.1.1.4
K	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Living things need water, air, and resources from the land, and they live in places that have the things they need. (ESS3.A)	Use a model to explain the relationship between the needs of different plants or animals and the places they live. ((K-ESS3-1)	Habitat Model Needs Relationship	3.1.4.A 3.1.4.B 3.1.4.C 3.2.4.A 3.2.4.B 3.3.4.A 3.3.4.B 3.3.4.A 3.4.4.A 3.4.4.B 3.4.4.D 4.1.4.A 4.1.4.B 4.2.4.A 4.4.4.B 4.5.4.D 4.2.4.C	3.1.3.A2 3.1.4.A2 3.1.4.A8 3.1.3.C2	S4.A.1.3 S4.A.2.1 S4.B.2.1

						4.5.3.A 4.5.4.D		
K	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Animals have identifiable structures and behaviors.	Observe and describe structures of organisms and functions of the structures.	Function Patterns Structure	3.3.4.A	3.1.3.A.5 3.1.k.A.5 3.1.1.A.5	S4.B.1.1.2
K	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	N/A	N/A	N/A	N/A	N/A	N/A
K	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	N/A	N/A	N/A	N/A	N/A	N/A
First Grade								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
1	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Organisms have external structures that serve various functions in growth, survival, behavior, and reproduction. (LS1.A)	Observe and categorize living and nonliving things by external characteristics. (1-LS1-1)	Organism Structures	3.3.4.A 3.3.4.B 3.1.4.A 3.2.4.A 3.2.4.B 3.2.4.C 4.7.4.A 4.7.4.B	3.1.4.A 3.1.4.B	S4.B.1.1.2 S4.B.1.1.3 S4.B.1.1.4 S4.B.1. 1.1 S4.B.1.1.2
1	All organisms are made of	How do organisms live, grow,	Organisms have external	Make observations and describe the	Grow	3.3.4.A	3.1.2.C	S4.A.3.1.1

	cells and can be characterized by common aspects of their structure and functioning.	respond to their environment, and reproduce?	structures that help them survive, grow and meet their needs. (LS1.A)	different parts of organisms that help them survive, grow, and meet their needs. (1-LS1-2)	Movement Observations Parts (roots, leaves, flowers, stems, fruit) Reproduce Survival Survive	3.3.4.B 3.1.4.A 3.2.4.A 3.2.4.B 3.2.4.C 4.7.4.A 4.7.4.B		S4.B.1.1.1 S4.B.1.1.3
1	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Organisms have external structures that help them survive, grow and meet their needs. (LS1.A)	Design a model that replicates the function of an organism's structure. (1-LS1-1)	Behavior Model	3.3.4.C 3.1.7.C 3.2.4.A 3.2.4.B 3.2.4.C 4.7.4.A 4.7.4.B	3.1.4.A	S4.B.1.1.1 S4.B.1.1.3 S4.B.1.1.4 S4.A.2.1.1
1	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Parents and offspring engage in behaviors that help the offspring to survive. (LS1.B)	Observe and determine patterns in behavior of parents and offspring that help offspring survive. (1-LS1-2)	Behavior Observe Offspring Patterns	3.3.4.A 3.3.4.B 3.1.4.A 3.2.4.A 3.2.4.B 3.2.4.C 4.7.4.A 4.7.4.B	3.1.2.C	S4.A.3.1.1 S4.B.1.1.1 S4.B.1.1.3
1	Organisms have external structures that help them survive, grow and meet their needs.	Organisms have external structures that help them survive, grow and meet their needs.	Organisms have external structures that help them survive, grow and meet their needs. (LS1.A)	Classify plants and animals according to physical characteristics they share. (1-LS1-1)	Classify Physical characteristic	3.3.4.C 3.1.7.C 3.2.4.A 3.2.4.B 3.2.4.C 4.7.4.A 4.7.4.B	3.1.4.A	S4.B.1.1 S4.B.1.1.1 S4.B.1.1.3
1	Organisms have external structures that help them survive, grow and meet their needs.	Organisms have external structures that help them survive, grow and meet their needs.	Every human made product is designed by applying knowledge of the natural world and is built using materials from nature. (LS1.A)	Use materials to design a solution to a human problem by mimicking how plant or animals use their external parts to help them survive, grow and meet their needs. (1-LS3-1)	Mimic Problem Solution	3.24..D	3.1.4.A 3.6.4.A	S.4.A.1.1.2 S4.B.1.1.3
1	Organisms grow,	How and why do organisms	N/A	N/A	N/A	N/A	N/A	N/A

	reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	interact with their environment and what are the effects of these interactions?						
1	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	Young animals are very much but not exactly like their parents. Plants also are very much, but not exactly, like their parents. (LS3.A)	Make observations and to construct an evidence-based account that young plants and animals are alike but not exactly like their parents. (1-LS3-1)	Similar Vary	3.3.4.C 3.1.7.C 3.2.4.A 3.2.4.B 3.2.4.C 3.3.4.C 4.7.4.A	3.1.4.B 3.1.4.C 3.1.KB1	S4.B.2.2.1
1	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	Adult plants and animals have young. In many kinds of animals, parents and the offspring engage in behaviors that help the offspring to survive. (LS1.B)	Note patterns in characteristics or behaviors that appear in adult and offspring (e.g. hair color, eye color,). (1-LS1-2)	Offspring Patterns	3.3.4.C 3.1.7.C 3.2.4.A 3.2.4.B 3.2.4.C 3.3.4.C 4.7.4.A 4.7.4.B	3.1.B.5 3.1.4.B.1 3.1.B5	S4.A.3.3.1 S4.B.2.1.2 S4.B.2.2.1
1	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	Offspring resemble their parents, but can also vary in many ways. (LS3.A)	Conduct an investigation (e.g. plant seeds, eggs) and cite evidence of change from young to adult. (1-LS3-1)	Characteristics Evidence Inherit Offspring Parents	3.3.4.C 3.1.7.C 3.2.4.A 3.2.4.B 3.2.4.C 3.3.4.C 4.7.4.A 4.7.4.B	3.1.4.B 3.1.4.C 3.1.K.A3	S4.B.2.2.1
1	Heredity refers to specific mechanisms by which characteristics or traits	How are the characteristics of one generation passed to the next? How can individuals of	Plants and animals have a life cycle.	Observe and compare the stages of life cycles of organisms (plants & animals).	Plants Animals Life cycles	3.1.4.C 3.1.4.E 3.3.4.A	3.1.K.A.3	S4.A.3.3.1 S4.B.1.1.5

	are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	the same species and even siblings have different characteristics?						
1	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	N/A	N/A	N/A	N/A	N/A	N/A
Second Grade								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
2	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	N/A	N/A	N/A	N/A	N/A	N/A
2	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Animals can move around, but plants cannot, and they often depend on animals for pollination or seed dispersal. (LS2.A)	Develop a model to demonstrate different modes of seed dispersal. Plan and investigate effectiveness of different types of seed dispersal. (2-LS2-2)	Pollination Seed dispersal	3.3.4A	3.1.4.A 3.1.4.B 3.1.4.C 4.1.4.A 4.5.4.D 4.2.4.C	S4.B.1.1.1 S4.B.1.1.5 S4.B.2.1.1
2	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent	How and why do organisms interact with their environment and what are the effects of these interactions?	Different plants survive better in different settings because they have varied needs for water, minerals, and sunlight. (LS2.A)	Plan and carry out investigations to test whether plants from different settings have different needs for water, sunlight, and type of soil. (2-LS2-1)	Soil Sunlight Minerals Water	3.3.4A	3.1.4.A.2 3.1.4.B.5 3.1.4.C.1 4.1.4.A 4.5.4.D 4.2.4.C	S4.B.2.1.1 S4.B.2.1.2

	relationships with other organisms and the physical environment.						3.1.5.C.1	
2	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Organisms obtain the materials they need to grow and survive from their environment. (LS2.A)	Obtain, evaluate, and communicate information that in any particular environment, some kinds of organisms survive well and some do not. (2-LS2-2)	Environment Survive	4.6.4A	3.1.4.A.2 3.1.4.C.1 4.5.4.D. 4.2.4.C 3.1.5.C.1	S4.B.2.1.1 S4.B.2.1.2
2	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Plants depend on water and light to grow. LS2.A)	Plan and conduct an investigation to determine if plants need sunlight and water to grow. (2-LS2-2)	Minerals Soil Sunlight Water	3.3.4A	3.1.4.A.2 3.1.4.B.5 3.1.4.C.1 4.1.4.A 4.5.4.D 4.2.4.C 3.1.5.C.1	S4.B.2.1.1 S4.B.2.1.2
2	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	N/A	N/A	N/A	N/A	N/A	N/A
2	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Living things can survive only where their needs are met. (LS4.D)	Construct an explanation about why living things can only survive where their needs are met. (2-LS4-1)	Biodiversity Microorganisms Needs Organism Survive	4.1.4C 4.1.4D	3.1.4.A 3.1.4.C 4.5.4.D 4.2.4.C	S4.B.2.1.2

2	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	There are many different kinds of living things in any area, and they exist in different places on land and in water. (LS4.D)	Observe and compare the different kinds of living things that are found in different habitats. (2-LS4-1)	Biodiversity Exist Habitats Land Living things Water	4.1.4C 4.1.4D	3.1.4.A 3.1.4.C 4.5.4.D 4.2.4.C	S4.B.2.1.1 S4.B.2.1.2
Third Grade								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
3	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Reproduction is essential to the continued existence of every kind of organisms. (LS1.B)	Use models to explain how reproduction is essential for every kind of organism. (3-LS1-1)	Life cycle Offspring Parents Reproduce Survival	3.3.4.C 3.1.4.B	3.1.4.A 3.1.4.B 3.1.4.C 4.1.4.A 4.5.4.D 4.2.4.C	S4.A.3.2 S4.B.1.1.5
3	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Plants and animals have unique and diverse life cycles that include birth, growth, reproduction, and death. (LS1.B)	Develop a model to describe the commonalities of life cycles of different organisms. (3-LS2-1)	Life cycle Offspring Parents Reproduce Survival	3.3.4.A 3.1.4.B	3.1.4.A 3.1.4.B 3.1.4.C 4.1.4.A 4.5.4.D 4.2.4.C	S4.A.3.2. S4.B.1.1.5
3	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Animals depend on each other and their surroundings to get what they need, including food, water, shelter, and a stable temperature. Groups serve different functions and vary in size. (LS2.D)	Based on observations, construct an argument that some animals form groups that help members survive. (3-LS2-1)	Basic needs Consumer Heterotroph Representation Stable	3.2.4.A 3.3.4.A 4.6.4.A	3.1.4.A 3.1.4.C 3.2.4.A 3.2.4.B 3.3.4.B 3.4.4.A 3.4.4.B 3.4.4.E 4.1.4.A 4.1.4.B 4.1.4.C 4.2.4.A 4.2.4.B 4.2.4.C 4.4.4.B	S4.A.3.1.2 S4.A.3.1.3 S4.B.2.1.1 S4.B.3.1.1

							4.5.4.D	
3	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	When the environment changes in physical characteristics, temperature, availability of resources, some organisms survive, others move, yet others may die. (LS4.C)	Construct an argument with evidence that within a specific habitat, some organisms survive well, some not so well, and others cannot survive at all. (3-LS4-3)		3.3.4.D	3.1.4.A 3.1.4.B 3.1.4.C 3.1.4.E 3.2.4.A 3.2.4.B 3.3.4.A 3.3.4.B 3.4.4.B 3.4.4.D 3.4.4.E 4.1.4.A 4.1.4.E 4.4.4.A 4.4.4.D 4.5.4.A 4.5.4.C	S4.B.3.2.1 S4.B.3.2.2 S4.B.3.2.3 S4.A.1.1.1 S4.A.1.3.2 S4.A.1.3.4 S.4.A.3.2.1 S4.A.3.3.2
3	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	Different organisms vary in how they look and function because they have different inherited information. (LS3.B)	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. (3-LS3-1; 3-LS3-2)	Inheritance Traits	3.3.4.C	3.1.3.B1	S4.A.2.1.3 S4.B.2.2.
3	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	The environment also affects the traits that an organism develops. (LS3.B)	Use evidence to support an explanation that the environment can influence traits. (3-LS3-2)	Environment Evidence Influence	3.3.4.C	3.1.3.B1	S4.A.2.1.3 S4.B.2.2.
3	Heredity refers to specific mechanisms by which	How are the characteristics of one generation passed to the	Many characteristics involve both inherited traits and	Use evidence to compare characteristics inherited from	Characteristics Environmental	3.3.4.C	3.1.4.A 3.1.4.B	S4.B.2.1.1 S4.B.2.2.1

	characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	next? How can individuals of the same species and even siblings have different characteristics?	environmental factors. (LS3.B)	parents, characteristics caused by the environment, and those resulting from both. (3-LS3-1; 3-LS3-2)	factors Generation Inherited Siblings Traits Variation		3.1.4.C 4.5.4.D 4.2.4.C	
3	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Some plants and animals that once lived on earth are no longer found anywhere. (LS4.A)	Analyze and interpret data from fossils to provide evidence of the organisms and environments in which they lived long ago.(3-LS4-1)	Extinct Fossils	4.7.4.C		S.4.A.2.1.4
3	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Fossils provide evidence about types of organisms that lived long ago as well as about the nature of the environment. (LS4.A)	Analyze and interpret data from fossils to provide evidence of the organisms and environments in which they lived long ago. (3-LS4-1)	Extinct Fossils	4.7.4.C	3.1.2.C3 3.1.3.C3	S.4.A.2.1.4
3	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Changes in an organism's habitat can be beneficial or harmful to the organism. (LS4.D)	Use evidence to argue that when the environment changes in ways that affect a place's physical characteristics, organisms may survive, move to new locations, or die. (3-LS4-3)	Adapt Endangered Habitat	3.3.4.D 4.7.4.A 4.7.4.B	3.1.4.A 3.1.4.B 3.1.4.C 3.1.4.E 3.2.4.A 3.2.4.B 3.3.4.A 3.3.4.B 3.4.4.B 3.4.4.D 3.4.4.E 4.1.4.A 4.1.4.E 4.4.4.A 4.4.4.D 4.5.4.A 4.5.4.C	S4.B.3.2.1 S4.B.3.2.2 S4.B.3.2.3 S4.A.1.1.1 S4.A.1.3.2 S4.A.1.3.4 S.4.A.3.2.1 S4.A.3.3.2

3	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Populations live in a variety of habitats and changes in those habitats impacts the organisms living there. (LS4.D)	Using evidence, make a claim about merits of solutions to problems caused when the environment changes and types of animals and plants that live there may change. (3-LS4-4)	Habitats Populations	3.3.4.D 4.8.4.C 3.3.4.D 4.7.4.A 4.7.4.B	3.1.4.A 3.1.4.B 3.1.4.C 3.1.4.E 3.2.4.A 3.2.4.B 3.3.4.A 3.3.4.B 3.4.4.B 3.4.4.D 3.4.4.E 4.1.4.A 4.1.4.E 4.4.4.A 4.4.4.D 4.5.4.A 4.5.4.C	S4.B.3.2.1 S4.B.3.2.2 S4.B.3.2.3 S4.A.1.1.1 S4.A.1.3.2 S4.A.1.3.4 S.4.A.3.2.1 S4.A.3.3.2
3	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Sometimes differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (LS4.B)	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. (3-LS4-S)		4.7.4.A 4.7.4.B		S4.A.1.3.4
3	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Fossils provide evidence about the types of organisms (both visible and microscopic) that lived long ago and also about the nature of their environments. (LS4.A)	Use evidence to construct an explanation that some rocks and minerals record the remains of organisms. (3-LS4-1)	Fossils Microscopic	3.5.4.A 4.7.4.B	3.1.4.A 3.1.4.C 4.5.4.D 4.2.4.C	S4.B.2.1.2
3	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Fossils provide evidence about the types of organisms (both visible and microscopic) that lived long ago and also about the nature of their environments. (LS4.A)	Obtain and communicate information that some organisms that once lived on earth are no longer found anywhere, although other organisms now may resemble them. (3-LS4-1)	Microscopic organism Organism Visible organism	3.5.4.A 3.3.4.D	3.1.4.A 3.1.4.C 4.5.4.D 4.2.4.C	S4.B.2.1.2

3	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Fossils can be compared with one another and to living organisms according to their similarities and differences. (LS4.A)	Use evidence from fossil records to construct an explanation of the relationship between types of organisms living today and types of organisms that lived in the past. (3-LS4-4)	Explanation Fossil record	3.5.4.A 3.1.3C3	3.1.4.A 3.1.4.C 4.5.4.D 4.2.4.C	S4.B.2.1.2
3	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Fossils can be compared with one another and to living organisms according to their similarities and differences. (LS4.B)	Use evidence to construct explanations for how environments today may be different from past environments in which fossilized organisms once lived. (3-LS4-4)	Fossil	3.5.4.A	3.1.4.A 3.1.4.C 4.5.4.D 4.2.4.C	S4.B.2.1.2
3	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing. (LS4.B)	Use evidence to explain how some characteristics that vary among individuals of the same kind of organism can provide advantages to survive, find mates, and reproduce. (3-LS4-2)	Reproduce Survive	3.3.4.A	3.1.3.C1 3.1.4.A 3.1.4.C 4.5.4.D 4.2.4.C	S4.B.2.1.2
3	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Humans, like all other organisms, obtain living and nonliving resources from their environments.	Use evidence to demonstrate how humans, like all other organisms, obtain living and non-living resources from their environment.	Living Non-Living	3.3.4.A	3.1.4.A 3.1.4.C 3.1.4.E 3.2.4.A 3.2.4.B 3.3.4.B 3.4.4.A 3.4.4.B 3.4.4.E 3.4.4.D 4.1.4.A 4.1.4.B 4.1.4.E 4.2.4.A 4.3.4.A 4.4.4.A 4.4.4.B 4.4.4.D	S4.B.3.3.1 S4.B.3.3.2 S4.B.3.3.3 S4.B.3.3.4 S4.B.3.3.5 S4.A.1.1.2 S4.A.1.3.5 S4.A.3.1.4

							4.5.4.A 4.5.4.C	
Fourth Grade								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
4	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Plants and animals have internal and external structures that serve various functions to survive. (LS1.A)	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. (4-LS1-1)	Behaviors Cause and effect Function Offspring Reproduce Structure Survival System System Models	3.3.4 C	3.1.4.A 3.1.4.B 3.1.4.C 4.1.4.A 4.5.4.C 4.2.4.C 3.1.3.A.1	S4.B.1.1.5
4	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	N/A	N/A	N/A	N/A	N/A	N/A
4	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	N/A	N/A	N/A	N/A	N/A	N/A
4	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	N/A	N/A	N/A	N/A	N/A	N/A

	Earth.							
Fifth Grade								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
5	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Food provides animals with materials needed for body repair and growth. (PS3.D)	Use a model to describe that energy in animal's food was once energy from the sun. (5-PS3-1)	Food chain Food web	3.3.7.A 3.2.7.B 3.1.7.A 3.1.7.C	3.1.7.A8	S8.B.3.1.1 S8.B.3.1.3 S8.A.3.2.1 S8.A.3.2.3
5	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Food provides animals with materials needed for energy and to maintain body warmth and for motion. (LS1.C)	Use a model to describe that energy in animal's food was once energy from the sun. (5-PS3-1)	Food chain Food web	3.3.7.A 3.2.7.B 3.1.7.A 3.1.7.C	3.1.7.A8	S8.B.3.1.1 S8.B.3.1.3 S8.A.3.2.1 S8.A.3.2.3
5	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Plants acquire their material for growth primarily from air and water. (LS1.C)	Using evidence, present an argument that plants get the materials they need for growth primarily from air and water. (5-PS3-1)	Argument Evidence Minerals	3.3.7.A 3.2.7.B 3.1.7.A 3.1.7.C	3.1.7.A8	S8.B.3.1.1 S8.B.3.1.3 S8.A.3.2.1 S8.A.3.2.3
5	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Animals and plants alike take in gases and water and release waste matter into the environment; animals must take in food, and plants need light and minerals. (LS2.B)	Construct and communicate models of food webs that demonstrate the transfer of matter and energy among organisms within an ecosystem. (5-LS2-1)	Ecosystem Food webs	3.3.7.A 3.2.7.B 3.1.7.A 3.1.7.C	3.1.7.A8	S8.B.3.1.1 S8.B.3.1.3 S8.A.3.2.1 S8.A.3.2.3
5	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the	How and why do organisms interact with their environment and what are the effects of these interactions?	Organisms can survive only in environments in which their particular needs are met. (LS2.A)	Ask researchable questions about the ways organisms obtain matter and energy across multiple and varied ecosystems. (5-LS2-1)	Researchable Species Web of life	3.3.7.A 3.2.7.B	3.1.6.A2	S8.B.3.1.1

	physical environment.							
5	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	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. (LS2.A)	Construct a model of a food web to demonstrate the transfer of matter and energy among organisms within an ecosystem. (5-LS2-1)	Ecosystem Transfer energy	3.3.7.A 3.2.7.B	3.1.6.A2	S8.B.3.1.1
5	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Newly introduced species can damage the balance of an ecosystem. (LS2.A)	Identify a newly introduced species to an ecosystem and provide evidence that it is an invasive species or noninvasive species. (5-LS2-1)	Ecosystem Invasive Noninvasive Species System	3.2.7.B 3.1.7.B	3.1.6.A2	S8.B.3.1.1 S8.B.3.1.2 S8.B.3.1.3
5	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. (LS2.B)	Use models to trace the cycling of particles of matter between the air and soil and among plants, animals, and microbes. (5-LS2-1)	Cycles Matter Microbes	3.3.7.C 3.2.7.B 3.1.7.B	3.1.6.A2	S8.B.3.1.1 S8.B.3.1.2
5	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. (LS2.B)	Use models to describe how decomposition eventually restores (recycles) some materials back to the soil for plants to use. (5-LS2-1)	Decomposers Decomposition Microbes	3.2.7.B 3.1.7.B	3.1.6.A2	S8.B.3.1.1 S8.B.3.1.2 S8.B.3.1.3

5	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	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. (LS2.A)	Describe a healthy ecosystem as a system in terms of the components and interactions. (5-LS2-1)	Ecosystem Components System System models	3.2.7.B 3.1.7.B	3.1.6.A2	S8.B.3.1.1 S8.B.3.1.2 S8.B.3.1.3
5	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	N/A	N/A	N/A	N/A	N/A	N/A
5	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	N/A	N/A	N/A	N/A	N/A	N/A
Middle School								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
6-8	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	All living things have a common set characteristic needs and functions that separate them from nonliving things such as: gas exchange, energy usage, water usage, response, reproduction, elimination of waste, growth, and made of	Use evidence of characteristics of life to differentiate between living and nonliving things.	Dead Dormant Living Nonliving	3.3.7B	3.1.6.A 3.1.7.A	

			one or more cells.					
6-8	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).	Conduct investigations to provide evidence that living things are made of cells and cells can be differentiated.	Eukaryote Multicellular Prokaryote Unicellular	3.3.7A 3.3.7B	3.1.6.A 3.1.7.A 3.1.8.A	S.8.B.1.1.1 S.8.B.1.1.2 S.8.B.1.1.3
6-8	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Within cells, special structures are responsible for particular functions.	Create and use models to describe the basic structures and functions of cells within a system framework.	Cell membrane Cell wall Chloroplast Cytoplasm Mitochondria Nucleus Organelles	3.3.7A 3.3.7B	3.1.6.A 3.1.7.A 3.1.8.A	S.8.B.1.1.1 S.8.B.1.1.2
6-8	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	In multicellular organisms, there is a systems framework of organization from cells to tissues, to organs to organ systems. These systems are specialized for particular body functions of an organism.	Provide evidence to support the concept of an organism is composed of interacting subsystems composed of a group of cells.	Cells Molecules Organ systems Organelles Organs Tissues	3.3.7.A 3.3.7.B	3.1.6.A 3.1.7.A 3.1.8.A	S.8.B.1.1.1 S.8.B.1.1.2 S.8.B.1.1.3 S.8.B.1.1.4
6-8	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	All living things have adaptations that help them survive and reproduce in their environment.	Use argument based evidence to support the notion that living things are able to survive and reproduce based on structural or behavioral adaptations.	Adaptations: structural, behavioral	3.3.7.D	3.1.6.A 3.1.7.A 3.1.8.A	S.8.B.2.1.1 S.8.B.2.1.2
6-8	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Living organisms reproduce in a variety of ways that may involve sexual or asexual reproduction. Reproduction usually follows a cycle.	Describe and distinguish between various types of reproductive methods of cells and organisms.	Asexual reproduction Cell division Life cycles Sexual reproduction	3.3.7.B	3.1.6.A 3.1.7.A 3.1.8.A	
6-8	All organisms are made of	How do organisms live, grow,	Genetic factors as well as	Provide a scientific explanation	Environmental	3.3.7.D	3.1.6.A	S.8.B.3.2.1

	cells and can be characterized by common aspects of their structure and functioning.	respond to their environment, and reproduce?	local conditions affect the growth of organisms.	based on evidence for how environmental and genetic factors influence the growth of organisms.	factors Genetic factors Scientific explanation		3.1.7.A 3.1.8.A	S.8.B.3.2.3
6-8	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Some organisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen.	Create a scientific, evidence-based explanation of the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.	Carbon dioxide Glucose Oxygen Photosynthesis Products Water Reactants	3.3.7.B 4.1.7.C	3.1.6.A 3.1.7.A 3.1.8.A	S.8.C.1.1.3 S.8.C.2.1.1 S.8.C.2.1.3 S.8.C.2.2.1
6-8	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy.	Create a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism	Aerobic respiration Anaerobic respiration Cellular respiration Fermentation	3.3.7B 4.1.7.C	3.1.6.A 3.1.7.A 3.1.8.A	S.8.C.1.1.3 S.8.C.2.1.1 S.8.C.2.1.3 S.8.C.2.2.1
6-8	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Organisms have sense receptor that responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to a brain or processing center. These signals are processed and result in immediate behaviors or memories.	Gather information that sensory receptors respond to stimuli by sending messages to the brain or processing center for immediate behavior or storage as memories.	Brain Nerves Neurons Response Signal Stimuli	Not mentioned in 2002 standards		S.8.B.2.1.1
6-8	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	Organisms have characteristic behaviors and structures that increase their odds of reproduction.	Utilize empirical evidence to support an argument that organism have characteristic behaviors and structures that increase their odds of reproduction.	Adaptations: structural, behavioral	3.3.7.D	3.1.8.C	S.8.B.2.1.1 S.8.B.2.1.2

6-8	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Organisms and populations of organisms are dependent on their environmental interactions, both biotic and abiotic factors.	Analyze data to provide evidence for the impact of resource availability on organisms and populations in an ecosystem.	Abiotic Biotic Consumer Ecosystem Energy pyramid Food chain Food web Niche Predator Prey Producer Symbiosis	4.3.7.C 4.6.7.A 3.2.7.B	3.1.6.A2 4.1.7.A 3.1.7.A	S8.B.3.1.1 S8.B.3.1.3
6-8	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	In **any** ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.	Analyze data to provide evidence for the impact of resource availability on organisms and populations in an ecosystem.	Capacity Carrying Dynamics Limiting factor Population	4.6.7.A 3.2.7.B 3.3.7.D	3.1.6.A2	S8.B.3.1.1 S8.B.3.1.2 S8.B.3.2.1 S8.B.3.2.2
6-8	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Growth of organisms and population increases are limited by access to resources.	Analyze data to provide evidence for the impact of resource availability on organisms and populations in an ecosystem.	Carrying capacity Community Competition Limiting factors Population	4.6.7.C 3.1.7.E	3.1.8.A 3.4.8.A 3.4.8.B 4.2.8.C 4.4.8.A 4.5.8.A 4.5.8.C 4.5.8.D	S8.B.3.2.1 S8.B.3.2.2 S8.B.3.2.3
6-8	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other	How and why do organisms interact with their environment and what are the effects of these interactions?	Predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent	Develop an explanation that describes patterns of interactions among organisms across multiple ecosystems.	Commensalism Mutualism Parasitism Predator Prey Resource availability	4.6.7.A	3.1.8.A 3.3.8.A 3.4.8.B 4.3.8.A 4.4.8.A 4.5.8.A 4.5.8.C	S8.B.3.3.1 S8.A.1.2.4 S8.B.3.1.1 S8.B.3.1.2 S8.B.3.1.3

	organisms and the physical environment.		that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.		Symbiosis		4.5.8.D	
6-8	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level.	Design and/or construct a model to describe the cycling of matter and flow of energy and within the biotic and abiotic parts of an ecosystem.	Autotroph Carnivore Competition Consumer Decomposer Energy pyramid Food chain Food web Herbivore Heterotroph Omnivore Photosynthesis Predation Primary Producer Secondary Tertiary	4.6.7.A 3.1.7.A 3.1.7.B	3.1.7.A2	S.8.B. 3.1.3 S.8.B.3.1.1
6-8	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments.	Design and/or construct a model to describe the cycling of matter and flow of energy and within the biotic and abiotic parts of an ecosystem.	Autotroph Carnivore Competition Consumer Decomposer Energy pyramid Food chain Food web Herbivore Heterotroph Omnivore	4.6.7.A 3.1.7.A 3.1.7.B	3.1.7.A2	S.8.B. 3.1.3 S.8.B.3.1.1

					Photosynthesis Predation Primary Producer Secondary Tertiary			
6-8	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.	Design and/or construct a model to describe the cycling of matter and flow of energy and within the biotic and abiotic parts of an ecosystem.	Autotroph Carnivore Competition Consumer Decomposer Energy pyramid Food chain Food web Herbivore Heterotroph Omnivore Photosynthesis Predation Primary Producer Secondary Tertiary	4.6.7.A 3.1.7.A 3.1.7.B	3.1.7.A2	S.8.B. 3.1.3 S.8.B.3.1.1
6-8	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.	Construct an argument supported by evidence that changes to the physical or biological parts of an ecosystem impact populations.	Conservation of matter Consumer Decomposer Flow of energy Producer	4.6.7.C 3.2.7.B	3.1.7.A.2	S8.B.3.1.1 S8.B.3.2.2 S8.B.3.2.3 S8.B.3.3.1 S8.B.3.2.1 S8.A.1.3.3 S8.A.1.3.4
6-8	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through	How and why do organisms interact with their environment and what are the effects of these interactions?	Biodiversity describes the variety of species found in Earth's terrestrial and aquatic ecosystems. The completeness or integrity of	Design or evaluate solutions for maintaining biodiversity and / or ecosystems services.	Biodiversity Food web Freshwater Oceanic Resiliency	4.3.7.C	3.1.7.A2	S8.B.3.1.1 S8.B.3.2.2

	interdependent relationships with other organisms and the physical environment.		an ecosystem's biodiversity is often used as a measure of its health.		Species Terrestrial			
6-8	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling of matter	Design or evaluate solutions for maintaining biodiversity and / or ecosystems services.	Carbon cycle Decomposition Nitrogen cycle Water cycle	4.6.7.A 3.2.7.C	3.1.7.A2	S8.B.3.1.1 S8.B.3.3.3 S8.B.3.3.4 S8.B.3.3.2
6-8	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.	Design or evaluate solutions for maintaining biodiversity and / or ecosystems services.	Ecosystem	4.6.7.C 3.2.7.C	3.1.8.A 3.4.8.A 4.2.8.C	S8.B.3.2.1 S8.B.3.2.3
6-8	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems.		Biodiversity Oceanic Terrestrial	4.3.7 C 3.1.7.B	3.1.8.A 3.4.8.A 4.2.8.C 3.1.8.C1	S8.B.3.2.2
6-8	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known	Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate	Evolution Evolutionary descent Evolutionary history Fossil Fossil record	3.1.7.C 3.1.10.D 3.2.7.C 3.2.7.A	3.1.8.A 3.4.8.A 4.2.8.C 3.1.8.C	S8.B.2.1.5 S8.B.2.1.1

			as the fossil record. It documents the existence, diversity, change, and extinction, of many life forms throughout the history of life on Earth.	today as in the past	Homologous structures Radioactive dating			
6-8	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Anatomical similarities and differences among various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent.	Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.	Anatomical Anatomical fossil record Evolutionary descent Evolutionary history Fossil Fossil record Homologous structures Natural selection	4.7.7.A 3.2.7.A 3.3.7.D 3.2.10.A 3.2.7.C	3.1.8.C 3.4.8.E	S8.B.2.1.2 S8.B.2.1.5 S8.B.2.1.1
6-8	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy.	-Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy	Embryological relationships	3.3.7.D, 3.3.10.D 3.2.7.A 3.2.10.A 3.3.7.C	3.1.8.C 3.4.8.E	S8.B.2.1.5
6-8	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Adaptations allow organisms to survive in their environment. Natural selection leads to the predominance of certain traits in a population, and the suppression of others.	Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.	Genetic variation Natural selection Predominance Suppression	3.3.7.D, 3.3.10.D 3.1.7.C 3.1.10.C 3.7.7.A	3.1.8.C 3.4.8.E	S8.B.2.1.5 S8B.3.2.3 S8B.2.1.1 S8B.2.1.2 S8B.2.1.3
6-8	Biological evolution explains both the unity and diversity of species	How can there be so many similarities among organisms yet so many different kinds of	In artificial selection, humans have the capacity to influence certain characteristics of	Gather and synthesize information about the technologies that have changed the way humans influence	Biotechnology Selective breeding	3.3.7.D, 3.3.10.D 3.1.7.C	3.1.8.C 3.4.8.E	S8.B.2.1.4 S8.B.2.1.3

	and provides a unifying principle for the history and diversity of life on Earth.	plants, animals, and microorganisms?	organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring.	the inheritance of desired traits in organisms		3.1.10.C 3.1.7.E 3.3.7.C 3.3.10.C		
6-8	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Adaptation by natural selection acting over generations is a process by which species change over time in response to changes in environmental conditions. Traits that support survival and reproduction in the new environment become more common; those that do not, become less common.	Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. If organisms cannot adapt to new environmental conditions, extinction can happen.	Adaptation Evolve Natural selection Variation	3.3.7.D, 3.3.10.D 3.2.7.A 3.2.10.A 4.7.7.B 3.1.7.B 3.1.10.B 3.1.7.D 3.1.7.E	3.1.8.A 3.1.8.C 3.4.8.B 3.4.8.E 4.4.8.A 4.5.8.A 4.5.8.C 4.5.8.D	S8.B.2.1.5 S8.B.2.1.1 S8.B.3.2.3 S8.B.3.2.2
6-8	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Explain how to use a dichotomous key to identify organisms.	Construct and utilize dichotomous keys to identify organisms	Dichotomous key Genus Species	3.3.7.A		S8.B.1.1.3
6-8	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next?	Animals engage in characteristic behaviors that increase the odds of reproduction.	Develop supporting statements based on scientific evidence and reasoning that explains how organismal behaviors and structures increase the probability of successful reproduction in living things.				S8.B2.1.2
6-8	Heredity refers to specific mechanisms by which characteristics or traits are passed from one	How can individuals of the same species and even siblings have different characteristics?	Organisms reproduce, either sexually or asexually, and transfer their genetic information through	Use a model that distinguishes how genetic information is conserved during asexual reproduction while sexual reproduction results in	Asexual reproduction DNA Mutations	3.3.7.C, 3.3.10.C	3.1.8.C	S8.B.2.2.1

	generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.		inheritance to their offspring.	variation.	Punnett squares Sexual reproduction			
6-8	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next?	Genetic contribution from each parent through sexual reproduction results in variation in offspring, and asexual reproduction results in offspring with identical genetic information.	Construct a model that demonstrates how gene mutations occur	Alleles Chromosomes DNA Genes Genetic Heredity	3.3.7.D 3.3.7.C 3.1.7.B	3.1.8.C 3.1.7.B1	S8.B.2.2.2 S8.B.2.1.3
6-8	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How can individuals of the same species and even siblings have different characteristics?	Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits.	Research and report on how gene structural changes may be beneficial or harmful to the organism.	Egg cells Sperm cells		3.1.7.B1	S8.B.2.1.3
6-8	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How can individuals of the same species and even siblings have different characteristics?	In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are	Use a model that demonstrates how genetic mutations can result in changes in the associated protein.	Daughter cells Gametes	3.3.7.C, 3.1.7.B 3.1.10.B	3.1.7.C1 3.1.8.A 3.1.8.C 3.4.8.B 4.4.8.A 4.5.8.A 4.5.8.C 4.5.8.D 3.1.7.C2	S8.B.2.2.2 S8B. 3.2.3

			beneficial, others harmful, and some neutral to the organism.					
6-8	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How can individuals of the same species and even siblings have different characteristics?	Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited.	Provide an explanation for the relationship among changes (mutations) to genes, changes to the formation of proteins, and the effect on the structure and function of the organism and thereby traits.		3.3.7.C, 3.3.10.C 3.2.7.A 3.2.10.A	3.1.8.C 3.4.8.E	S8.B.2.1.3
6-8	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other.	Demonstrate using a model illustrating how offspring acquire genes from each parent during sexual reproduction.		3.3.7.C 3.1.7.B	3.1.8.C 3.4.8.E	S8.B.2.1.1 S8.B.2.2.2
6-8	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	Humans can select for specific traits, using technology for genetic modification, which leads to selective breeding.	Research and present a report that addresses the use of technologies allowing for the selection of specific genetic traits	Selective breeding			S8.B.2.1.4
High School								
Grade	**Big Idea**	**Essential Questions**	**Concepts**	**Competencies**	**Vocabulary**	**2002 Standards**	**SAS Standards**	**Assessment Anchor Eligible Content**
9-12	All organisms are made of cells and can be	How do organisms live, grow, respond to their environment,	DNA molecules contain genetic information that is	Use models to demonstrate how DNA sequences determine the	DNA sequence Gene	3.3.10.A 3.3.10.B	3.1.B.A1 3.1.B.A5	BIO.B.1.2.1 BIO.B.1.2.2

	characterized by common aspects of their structure and functioning.	and reproduce?	found in all cells. Genes are sections of DNA that code for proteins, which are important for cell functioning.	structure and function of proteins.	Genetic Information Inheritance Nucleotide Protein RNA Semiconservative replication Translation Transcription Uracil	3.3.10.C	3.1.B.B1 3.1.B.B3 3.1.B.B5 3.1.C.B3 3.1.C.C2	BIO.B.2.2.1 BIO.B.2.2.2 BIO.A.4.1.3
9-12	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Compare cellular structure and their functions in prokaryote and eukaryote cells.	Create a model to explain, compare and contrast the structure and function of prokaryote and eukaryote cells.	Eukaryote Prokaryote	3.3.4.B 3.3.7.B 3.3.10.B	3.1.B.A1	BIO.A.1.1.1
9-12	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level.	Formulate scientific explanations through models to explain the hierarchical organization of interacting systems working together to provide specific functions within multicellular organisms.	Cells Endoplasmic Eukaryote Extracellular Golgi apparatus Multicellular Organ Organ systems Organelle Prokaryote Reticulum Ribosome Tissues Unicellular	3.3.10.A	3.1.B.A1 3.1.B.A5 3.1.B.A6 3.1.B.C2 4.1.3.A 4.1.4.A	BIO.A.1.1.1 BIO.A.1.2.2
9-12	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Organisms maintain homeostasis in response changing conditions via positive and negative feedback mechanisms.	Plan and conduct an investigation to provide evidence and explain the function of positive and negative feedback mechanisms in maintaining homeostasis that is essential for organisms.	Homeostasis	3.1.10.A 3.3.10.B	3.1.B.A2 3.1.B.A4 3.1.B.A5 3.1.B.A7 3.1.B.A8 3.2.B.B6 3.2.C.A1	BIO.A.4.2.1 BIO.A.4.1.1 BIO.A.4.1.2

9-12	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Mitosis is the process in which individual cells multiply, which allows multicellular organisms to grow. Both daughter cells receive identical genetic information from the original parent cell.	Use a model to explain how mitotic cell division results in daughter cells with identical patterns of genetic materials essential for growth and repair of multicellular organisms.	Anaphase Cell cycle Cytokinesis Diploid Interphase Metaphase Mitosis Nuclear division Prophase Telophase	3.1.10.A 3.3.10.C	3.1.B.A4 3.1.B.A5 3.1.B.B2 3.1.B.B3 3.1.B.B5 3.1.B.C2 3.1.C.C2	BIO.B.1.1.1 BIO.B.1.1.2
9-12	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Within cells, special structures are responsible for particular functions.	Construct a model to illustrate the similarities and differences between active and passive transport processes.	Active transport Adhesion Carrier protein Cohesion Concentration Diffusion Endocytosis Exocytosis Facilitated diffusion Gradient Impermeable Osmosis Passive transport Permeable Plasma/Cell membrane Pumps (ion/molecular)	3.3.10.B	3.1.B.A5 3.1.B.A2 3.1.B.A4 3.1.B.A7 3.2.C.A1 3.2.P.B6	BIO.A.2.1.1 BIO.A.4.1.1 BIO.A.4.1.2 BIO.A.4.1.3
9-12	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Tissues and organs are produced by cellular division and differentiation, and they work together to meet a multicellular organism's needs.	Use a model to describe the role of cellular division and differentiation to produce and maintain complex organisms composed of organ systems and tissue subsystems that work together to meet the needs of the entire organism.	Cellular division Differentiation Gene Organ systems	3.3.10.A 3.3.10.C	3.1.B.A1 3.1.B.A5 3.1.B.A6	BIO.A.1.2.2
9-12	All organisms are made of	How do organisms live, grow,	In sexual reproduction,	Use a model to explain the role of	DNA	3.3.10.B	3.1.B.A1	BIO.B.1.2.1

	cells and can be characterized by common aspects of their structure and functioning.	respond to their environment, and reproduce?	specialized cell division, meiosis, occurs resulting in the production of sex cells (sperm and egg cells). Offspring inherit 23 chromosomes from each parent resulting in 46 total chromosomes.	cellular division and the mechanisms in meiosis for transmitting genetic information from parents to offspring.	Centrioles Centromere Chromatids Chromosomes Daughter cells Gametes Meiosis Parent cell Spindle fibers	3.3.10.C	3.1.B.A4 3.1.B.A5 3.1.B.B1 3.1.B.B2 3.1.B.B3 3.1.B.B5 3.1.B.C2 3.1.C.C2	BIO.B.1.1.2
9-12	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Photosynthesis is the process in which light energy is transformed into chemical energy; carbon dioxide and water react to form sugar and oxygen.	Construct a model to support explanations of the process of photosynthesis by which light energy is converted to stored energy.	Carbon-Based molecule Chloroplast Hydrocarbon Plastids	3.3.10.A 3.3.10.B 3.4.10.A	3.1.B.A2 3.1.B.A5 3.1.C.A1 3.1.C.A2 4.1.10.C	BIO.A.3.1.1 BIO.A.3.2.1 BIO.A.3.2.2
9-12	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Sugar molecules are carbohydrates with hydrocarbon backbones. These serve as the basis for amino acids and other larger organic molecules needed by the cell.	Construct a model that illustrates the biosynthesis of certain amino acids from metabolic products produced during aerobic respiration.	ADP/ATP Amino acid Glucose Organic molecule	3.3.10.A 3.3.10.B	3.1.B.A2 3.1.B.A5 3.1.B.A7 3.1.C.A1 3.1.C.A2 3.1.C.A7 4.1.10.C	BIO.A.3.1.1 BIO.A.3.2.1 BIO.A.3.2.2
9-12	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Chemical reactions are driven by matter and energy flowing through different organizational levels of biological systems which form different products.	Use a model to illustrate how cells use Carbon, Hydrogen, Oxygen, Nitrogen and Sulfur to synthesize biological macromolecules	Amino acid Biological macromolecules Carbohydrates Catalyst Dehydration Enzymes Hydrolysis Lipids Monomers Nucleic acids synthesis Polymers	3.1.10.B 3.3.10.B 3.4.10.A 3.4.10.B	3.1.B.A2 3.1.B.A7 3.1.B.A8 3.1.C.A2 3.1.C.A7 3.2.C.A2	BIO.A.2.2.1 BIO.A.2.2.2 BIO.A.2.2.3 BIO.A.2.3.2 BIO.A.2.3.1 BIO.A.2.3.2

9-12	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Energy flows through systems by means of chemical reactions. Aerobic cellular respiration involves a series of chemical reactions in which energy in food molecules can be converted into a form that the cell can readily use for life functions.	Use a model to explain cellular respiration as a chemical process whereby the bonds of food molecules and oxygen molecules are broken and bonds in new compounds are formed that result in a net transfer of energy.	Aerobic Bioenergetics Cellular respiration Electron Glycolysis Krebs cycle Mitochondria Transport chain	3.1.12.E 3.4.10.B	3.1.B.A2 3.1.B.A5 3.1.B.A7 3.1.C.A1 4.1.10.C	BIO.A.2.3.1 BIO.A.2.3.2 BIO.A.3.1.1 BIO.A.3.2.1 BIO.A.3.2.2
9-12	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Energy is transferred from one system to another as a result of chemical reactions.	Use a model to explain cellular respiration as a chemical process whereby the bonds of food molecules and oxygen molecules are broken and bonds in new compounds are formed that result in a net transfer of energy.	Electron transport chain Chloroplast Krebs cycle Plastids	3.1.12.E	3.1.B.A2 3.1.B.A5 3.1.B.A7 3.1.C.A1 4.1.10.C	BIO.A.2.3.1 BIO.A.2.3.2 BIO.A.3.1.1 BIO.A.3.2.1
9-12	All organisms are made of cells and can be characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	Anaerobic (without oxygen) cellular respiration follows a different and less efficient chemical pathway to provide energy in cells. Matter and energy are conserved in each change.	Evaluate data to compare the energy efficiency of aerobic and anaerobic respiration within organisms.	Anaerobic respiration	3.3.10.B	3.1.B.A2 3.1.B.A5 3.1.C.A1 4.1.10.C	BIO.A.3.2.1 BIO.A.3.2.2
9-12	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support.	Evaluate data to explain resource availability and other environmental factors that affect carrying capacity of ecosystems.	Carrying capacity Density dependent Density independent Ecosystem Limiting factors Population Resource availability	3.1.10.A 3.3.10.D 4.6.10.A 4.6.10.B 4.6.10.C	4.1.10.A 4.1.10.E 4.2.10.C 4.2.10.A 4.2.10.B 4.5.10.D 4.1.12.A	BIO.B.4.1.1 BIO.B.4.1.2 BIO.B.4.2.1 BIO.B.4.2.2 BIO.B.4.2.5
9-12	Organisms grow, reproduce, and	How and why do organisms interact with their environment	Ecosystems have carrying capacities, which are limits to	Plan and carry out investigations to make mathematical comparisons of	Carrying capacity	3.1.10.A 3.3.10.D	4.1.10.A 4.1.10.E	BIO.B.4.1.1 BIO.B.4.1.2

	perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	and what are the effects of these interactions?	the numbers of organisms and populations they can support.	the populations and biodiversity of two similar ecosystems at different scales.	Density dependent Density independent Ecosystem Limiting factors Population Resource availability	4.6.10.A 4.6.10.B 4.6.10.C	4.2.10.C 4.2.10.A 4.2.10.B 4.5.10.D 4.1.12.A	BIO.B.4.2.1 BIO.B.4.2.2 BIO.B.4.2.5
9-12	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Matter is transferred through organisms in an ecosystem; some is stored, but most is lost.	Use data to develop mathematical models to describe the flow of matter and energy between organisms and the ecosystem. Examples include trophic levels and feeding relationships (food webs/food chains) and the Ten percent law.	Biogeochemical cycles Biosynthesis Community Consumer Decomposers Food chain/web Mathematical model Producer	4.6.10.A 4.6.10.B 4.6.10.C	4.1.5.C 4.1.10.C 4.1.12.C	BIO.B.4.2.1 BIO.B.4.2.3 BIO.B.4.2.4
9-12	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes.	Use data to develop mathematical models to describe the flow of matter and energy between organisms and the ecosystem.	Cycling of matter Flow of energy	4.6.10.A 4.6.10.B 4.6.10.C	4.1.10.C 4.1.12.C	BIO.B.4.2.1
9-12	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Photosynthetic and/or chemosynthetic organisms form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release	Use data to develop mathematical models to describe the flow of matter and energy between organisms and the ecosystem.	Cellular respiration Chemosynthesis Community Cycling of matter Energy pyramid Flow of energy Food web	4.6.10.A	4.1.10.C 4.1.12.C	BIO.B.4.2.1 BIO.B.4.2.4

			energy in cellular respiration at the higher level.		Photosynthesis Trophic levels			
9-12	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Photosynthesis and cellular respiration are important components of the carbon cycle.	Use models to explain the roles of photosynthesis and cellular respiration in the carbon cycle specific to the carbon exchanges among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes.	Biological processes Biosphere Carbon cycle Chemical processes Geological processes Geosphere Hydrologic cycle Nitrogen cycle Physical processes	3.3.10.A 4.6.10.B	4.1.10.A 4.2.10.A 4.1.10.C 4.1.12.C	BIO.B.4.1.1 BIO.B.4.1.2 BIO.B.4.2.1 BIO.B.4.2.2 BIO.B.4.2.3
9-12	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Matter found in organisms is cycled through food webs, as well as the atmosphere and geosphere through biogeochemical cycles.	Provide evidence to support explanations of how elements and energy are conserved as they cycle through ecosystems and how organisms compete for matter and energy.	Biochemical conversion Biogeochemical cycles Conservation Energy Food web	4.6.10.A 4.6.10.B 4.6.10.C	4.1.10.A 4.1.10.C 4.1.12.C 4.2.10.A	BIO.B.4.1.1 BIO.B.4.1.2 BIO.B.4.2.1 BIO.B.4.2.2 BIO.B.4.2.4
9-12	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Competition among species is ultimately competition for the matter and energy needed for life.	Investigate and explain the evidence of competition on individual and species' chances to survive and reproduce.	Intraspecific competition Interspecific competition Predation Resource partitioning	4.6.10.A	4.1.10.A 4.1.10.C 4.1.12.C 4.2.10.A	BIO.B.4.1.1 BIO.B.4.1.2 BIO.B.4.2.1 BIO.B.4.2.2
9-12	Organisms grow, reproduce, and perpetuate their species by obtaining necessary	How and why do organisms interact with their environment and what are the effects of these interactions?	Significant changes in conditions or population sizes may affect the functioning of ecosystem's resources and	Construct and use a model to communicate how complex sets of interactions in ecosystems maintain relatively consistent numbers and	Abiotic Biotic Community Ecosystem	4.6.10.A	4.1.10.A 4.1.10.E 4.1.12.A 4.2.10.A	BIO.B.4.2.5 BIO.B.4.2.4

	resources through interdependent relationships with other organisms and the physical environment.		habitat availability. Population size and biodiversity remain relatively constant over time due to complex interactions within ecosystems.	types of organisms for long periods of time when conditions are stable.	Habitat Niche Symbiosis		4.2.10.B 4.2.10.C 4.5.10.D	
9-12	Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	How and why do organisms interact with their environment and what are the effects of these interactions?	Ecosystems are resilient, in that they can withstand moderate biological or physical disturbances and return to their original state.	Construct arguments from evidence about the effects of natural and human disturbances and biological or physical disturbances in terms of the time needed to reestablish a stable ecosystem and how the new system differs from the original system.	Endemic species Founder effect Genetic drift Migration Mutation Natural/Human disturbances Natural selection Nonnative species Resilient Succession	4.6.10.C	4.1.10.A 4.1.10.B 4.1.10.E 4.2.10.A 4.2.10.B 4.2.10.C 4.3.10.B 4.5.10.D 4.5.10.B 4.1.12.A 4.1.12.C 4.2.12.A 4.2.12.B 4.2.12.C 4.3.12.A 4.5.12.B	BIO.B.4.2.4 BIO.B.4.2.5
9-12	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA.	Ask questions and obtain information about the role of patterns of gene sequences in DNA molecules and subsequent inheritance of traits.	Allele Chromosome DNA Dominant allele Gene Gene expression Genotype Recessive allele Trait Phenotype	3.3.10.C	3.1.B.B3 3.1.C.B3	BIO.B.1.2.2
9-12	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different	All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways.	Construct an explanation for how cell differentiation is the result of activation or inactivation of specific genes as well as small differences in the immediate environment of the	Activation Inactivation Regulatory functions Structural	3.3.10.B 3.3.10.C	3.1.B.B1 3.1.B.B3 3.1.B.B5 3.1.C.B3 3.1.C.C2	BIO.B.2.2.1 BIO.B.1.2.2

	genes, and explains why offspring resemble, but are not identical to, their parents.	characteristics?		cells.	functions			
9-12	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	The information passed from parents to offspring is coded in the DNA molecules that form the chromosomes.	Using a model, explain information that inheritable genetic variations may result from (1) genetic combinations in haploid sex cells, (2) errors occurring during replication, (3) crossover between homologous chromosomes during meiosis, and (4) environmental factors.	Crossing-over Deletion Duplication Haploid cells Homologous chromosomes Insertion Inversion Meiosis Nondisjunction Translocation Variation	3.3.10.C	3.1.B.B1 3.1.B.B2 3.1.B.B3 3.1.C.C2	BIO.B.2.1.2
9-12	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	In sexual reproduction, chromosomes can create new genetic combinations through the process of meiosis, which creates new genetic combinations and more genetic variation.	Using a model, explain information that inheritable genetic variations may result from (1) genetic combinations in haploid sex cells, (2) errors occurring during replication, (3) crossover between homologous chromosomes during meiosis, and (4) environmental factors.	Crossing-over Deletion Duplication Haploid cells Homologous chromosomes Insertion Inversion Meiosis Nondisjunction Translocation Variation	3.3.10.C	3.1.B.B1 3.1.B.B2 3.1.B.B3 3.1.C.C2	BIO.B.2.1.2
9-12	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation.	Using a model, explain information that inheritable genetic variations may result from (1) genetic combinations in haploid sex cells, (2) errors occurring during replication, (3) crossover between homologous chromosomes during meiosis, and (4) environmental factors.	Chromosomes Crossing over Genetic variation Haploid cells Homologous Meiosis Nondisjunction	3.3.10.C	3.1.B.B1 3.1.B.B2 3.1.B.B3 3.1.B.C2 3.1.C.B3 3.1.C.C2	BIO.B.2.1.2 BIO.B.2.3.1 BIO.B.2.4.1
9-12	Heredity refers to specific	How are the characteristics of	Environmental factors can	Communicate information that	Chromosomes	3.3.10.C	3.1.B.B1	BIO.B.2.1.2

	mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	also cause mutations in genes, and viable mutations are inherited.	inheritable genetic variations may result from (1) genetic combinations in haploid sex cells, (2) errors occurring during replication, (3) crossover between homologous chromosomes during meiosis, and (4) environmental factors.	Chromosomal mutation Frame-shift mutation Haploid cells Homologous Meiosis Mutation Point mutation		3.1.B.B2 3.1.B.B3 3.1.B.B4 3.1.C.C2 4.4.10.A 4.4.12.A 4.4.10.B 4.4.12.B	BIO.B.2.4.1
9-12	Heredity refers to specific mechanisms by which characteristics or traits are passed from one generation to the next via genes, and explains why offspring resemble, but are not identical to, their parents.	How are the characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?	Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population.	Use probability to explain the variation and distribution of expressed traits in a population.	Codominance Dominant Incomplete dominance Multiple alleles Polygenic Probability Recessive Sex-linked	3.3.10.C	3.1.B.B5	BIO.B.2.1.1 BIO.B.3.3.1
9-12	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Evidence of evolution is found in anatomy, heredity, embryology, and the fossil record.	Use evidence obtained from technologies to compare similarity in DNA sequences, anatomical structures, and embryological appearance as evidence to support multiple lines of descent in evolution.	Analogous structures Embryology Homologous structures Molecular level Transitional forms Vestigial	3.3.10.D 3.5.10.A	3.1.B.A9 3.1.B.B3 3.1.B.C1 3.1.B.C3	BIO.B.3.2.1 BIO.B.3.3.1
9-12	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Natural selection occurs only if there is both a variation in the genetic information between organisms in a population and a variation in the expression of that genetic information (trait variation) that leads to differences in performance among individuals.	Plan and carry out investigations to gather evidence of patterns in the relationship between natural selection and changes in the environment.	Natural selection	3.3.10.D	3.1.B.C1	BIO.B.3.1.1 BIO.B.3.3.1
9-12	Biological evolution	How can there be so many	The traits that positively affect	Apply concepts of statistics and	Allele	3.3.10.C	3.1.B.C1	BIO.B.3.1.1

	explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	survival are more likely to be reproduced, and thus are more common in the population.	probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.	frequency	3.3.10.D		BIO.B.3.3.1
9-12	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Natural selection is the result of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources, and (4) the increase in number of those organisms that are better able to survive and reproduce in that environment.	Use models to explain how the process of natural selection is the result of four factors.	Competition Natural selection	3.3.10.B 3.3.10.D	3.1.B.C1	BIO.B.3.1.1
9-12	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Natural selection leads to adaptations.	Use evidence to explain the process by which adaptation drives natural selection that result in populations dominated by organisms that are anatomically, behaviorally, and physiologically able to survive and/or reproduce in a specific environment.	Adaptation: *Anatomical, * Behavioral, * Physiological * Biochemical * Embryological * Universal genetic code Coevolution Divergent evolution Gradualism	3.3.10.D 4.7.10.C	3.1.B.C1 3.1.B.C2	BIO.B.3.2.1 BIO.B.3.3.1
9-12	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Natural selection leads to adaptations.	Develop an argument to support the convergent or divergent changes among life on earth in response to earth's dynamic changes	Adaptation: *Anatomical, * Behavioral, * Physiological * Biochemical *	3.3.10.D 4.7.10.C	3.1.B.C1 3.1.B.C2	BIO.B.3.2.1 BIO.B.3.3.1

	Earth.				Embryological * Universal genetic code Coevolution Divergent evolution Gradualism			
9-12	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Differential survival and reproduction of organisms in a population that have advantageous heritable traits leads to an increase in future generations having the desired trait(s)	Investigate and communicate data describing how changes in environmental conditions can affect the distribution of traits in a population and cause increases in the numbers of some species, the emergence of new species, and the extinction of other species.	Emergence Extinction Speciation	4.7.10.C	3.1.B.C1 3.1.B.C2	BIO.B.3.1.2 BIO.B.3.3.1
9-12	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Changes to the physical world from both naturally occurring and human generated events can cause adverse effects on biodiversity.	Utilize a variety of data to provide evidence and construct explanations and design solutions for the impact of human activities on the environment including ways to sustain biodiversity and maintain the flow of the planet's future natural resources.	Invasive species Non-native species	4.8.10.A 4.8.10.C 4.8.10.D	4.1.10.A 4.1.10.B 4.1.10.E 4.1.12.A 4.1.12.C 4.2.10.A 4.2.10.B 4.2.10.C 4.2.12.A 4.2.12.B 4.2.12.C 4.3.10.B 4.3.12.A 4.5.10.B 4.5.10.D 4.5.12.B	BIO.B.4.2.4 BIO.B.3.3.1
9-12	Biological evolution explains both the unity and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?	Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). Biological extinction is a critical factor in reducing natural resources for	Design solutions for creating or maintaining the sustainability of local ecosystems.	Biological extinction Critical factor Design Ecosystems Speciation Sustainability	3.3.10.D 4.7.10.C	4.1.10.A 4.1.10.E 4.1.12.A 4.2.10.A 4.2.10.B 4.2.10.C 4.5.10.D	BIO.B.4.2.5

			future generations.					