

High School - Life Science

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 characterized by common aspects of their structure and functioning.	How do organisms live, grow, respond to their environment, and reproduce?	DNA molecules contain genetic information that is found in all cells. Genes are sections of DNA that code for proteins, which are important for cell functioning.	Use models to demonstrate how DNA sequences determine the structure and function of proteins.	DNA sequence Gene Genetic Information Inheritance Nucleotide Protein RNA Semiconservative replication Translation Transcription Uracil	3.3.10.A 3.3.10.B 3.3.10.C	3.1.B.A1 3.1.B.A5 3.1.B.B1 3.1.B.B3 3.1.B.B5 3.1.C.B3 3.1.C.C2	BIO.B.1.2.1 BIO.B.1.2.2 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	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

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				essential for organisms.				
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 cells and can be characterized by common aspects of their structure	How do organisms live, grow, respond to their environment, and reproduce?	In sexual reproduction, specialized cell division, meiosis, occurs resulting in the production of sex cells (sperm and egg cells). Offspring inherit 23	Use a model to explain the role of cellular division and the mechanisms in meiosis for transmitting genetic	DNA Centrioles Centromere Chromatids	3.3.10.B 3.3.10.C	3.1.B.A1 3.1.B.A4 3.1.B.A5 3.1.B.B1	BIO.B.1.2.1 BIO.B.1.1.2

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	and functioning.		chromosomes from each parent resulting in 46 total chromosomes.	information from parents to offspring.	Chromosomes Daughter cells Gametes Meiosis Parent cell Spindle fibers		3.1.B.B2 3.1.B.B3 3.1.B.B5 3.1.B.C2 3.1.C.C2	
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	How do organisms live, grow,	Energy is transferred from one system	Use a model to explain	Electron	3.1.12.E	3.1.B.A2	BIO.A.2.3.1

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	cells and can be characterized by common aspects of their structure and functioning.	respond to their environment, and reproduce?	to another as a result of chemical reactions.	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.	transport chain Chloroplast Krebs cycle Plastids		3.1.B.A5 3.1.B.A7 3.1.C.A1 4.1.10.C	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 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.	Plan and carry out investigations to make mathematical comparisons of the populations and biodiversity of two similar ecosystems at different scales.	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

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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 energy in cellular respiration at the higher level.	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 Photosynthesis Trophic levels	4.6.10.A	4.1.10.C 4.1.12.C	BIO.B.4.2.1 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 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,	How and why do organisms	Matter found in organisms is cycled	Provide evidence to support	Biochemical	4.6.10.A	4.1.10.A	BIO.B.4.1.1

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	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?	through food webs, as well as the atmosphere and geosphere through biogeochemical cycles.	explanations of how elements and energy are conserved as they cycle through ecosystems and how organisms compete for matter and energy.	conversion Biogeochemical cycles Conservation Energy Food web	4.6.10.B 4.6.10.C	4.1.10.C 4.1.12.C 4.2.10.A	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 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?	Significant changes in conditions or population sizes may affect the functioning of ecosystem's resources and habitat availability. Population size and biodiversity remain relatively constant over time due to complex interactions within ecosystems.	Construct and use a model to communicate how complex sets of interactions in ecosystems maintain relatively consistent numbers and types of organisms for long periods of time when conditions are stable.	Abiotic Biotic Community Ecosystem Habitat Niche Symbiosis	4.6.10.A	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 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?	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

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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 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?	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 cells.	Activation Inactivation Regulatory functions Structural functions	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
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	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

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					Variation			
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 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 can also cause mutations in genes, and viable mutations are inherited.	Communicate 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 Chromosomal mutation Frame-shift mutation Haploid cells Homologous Meiosis Mutation Point mutation	3.3.10.C	3.1.B.B1 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.2.1.2 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	How can there be so many similarities among organisms	Natural selection occurs only if there is both a variation in the genetic	Plan and carry out investigations to gather	Natural selection	3.3.10.D	3.1.B.C1	BIO.B.3.1.1 BIO.B.3.3.1

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	and diversity of species and provides a unifying principle for the history and diversity of life on Earth.	yet so many different kinds of plants, animals, and microorganisms?	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.	evidence of patterns in the relationship between natural selection and changes in the environment.				
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?	The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population.	Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.	Allele frequency	3.3.10.C 3.3.10.D	3.1.B.C1	BIO.B.3.1.1 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?	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 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.	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 * Embryological * Universal genetic code Coevolution	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

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					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 future generations.	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