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September	**StatementB1.1**	**Scientific Inquiry** Science is a way of understanding nature. Scientific research May begin by generating new scientific questions that can be answered through replicable scientific investigations that are logically developed and conducted systematically. Scientific conclusions and explanations result from careful analysis of empirical evidence and the use of logical reasoning. Some questions in science are addressed through indirect rather than direct observation, evaluating the consistency of new evidence with results predicted by models of natural processes. Results from investigations are communicated in reports that are scrutinized through a peer review process.		change, explain, gather, information, science, technology, variable, (data) log, accurate, average, belong, color, conclude, data, experiment, feet, measurement group, have in common, identify, notes, observation, population, probable reason, reason, result, scientific theory, scientist, smell, tool		
November	B1.1A	Generate new questions that can be investigated in the laboratory or field.				

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December	B1.1B	Evaluate the uncertainties or validity of scientific conclusions using an understanding of sources of measurement error, the challenges of controlling variables, accuracy of data analysis, logic of argument, logic of experimental design, and/or the dependence on underlying assumptions.		affect, control variables, direct observation, experimental result, hypothesis, investigation, prediction, study, test, valid		
December	B1.1C	Conduct scientific investigations using appropriate tools and techniques (e.g., selecting an instrument that measures the desired quantity—length, volume, weight, time interval, temperature—with the appropriate level of precision).		chance, common, control, decrease, design experiment, discard, formulate model, generalization, hold constant, increase, independent variable, interpret data, investigate, justify, material, pendulum, quality, quantity, random group, reject, reliable, scale (measurement), significant, statistics, texture, trial-and-error procedure		

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December	B1.1D	Identify patterns in data and relate them to theoretical models.				
December	B1.1E	Describe a reason for a given conclusion using evidence from an investigation.				
December	B1.1f	Predict what would happen if the variables, methods, or timing of an investigation were changed.				
December	B1.1g	Use empirical evidence to explain and critique the reasoning used to draw a scientific conclusion or explanation.				
December	B1.1h	Design and conduct a systematic scientific investigation that tests a hypothesis. Draw conclusions from data presented in charts or tables.		controlled experiment, dependent, orderly pattern, phenomena, probable, scientific evidence, testable, theorize		

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December	B1.1i	Distinguish between scientific explanations that are regarded as current scientific consensus and the emerging questions that active researchers investigate.				
December	**StatementB1.2**	**Scientific Reflection and Social Implications** The integrity of the scientific process depends on scientists and citizens understanding and respecting the "Nature of Science." Openness to new ideas, skepticism, and honesty are attributes required for good scientific practice. Scientists must use logical reasoning during investigation design, analysis, conclusion, and communication. Science can produce critical insights on societal problems from a personal and local scale to a global scale. Science both aids in the development of technology and provides tools for assessing the costs, risks, and benefits of technological systems. Scientific conclusions and arguments play a role in personal choice and public policy decisions. New technology and scientific discoveries have had a major influence in shaping human history. Science and technology continue to offer diverse and significant career opportunities.				

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November	B1.2A	Critique whether or not specific questions can be answered through scientific investigations.				
December	B1.2B	Identify and critique arguments about personal or societal issues based on scientific evidence.				
December	B1.2C	Develop an understanding of a scientific concept by accessing information from multiple sources. Evaluate the scientific accuracy and significance of the information.				
December	B1.2D	Evaluate scientific explanations in a peer review process or discussion format.				
December	B1.2E	Evaluate the future career and occupational prospects of science fields.				

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December/May	B1.2f	Critique solutions to problems, given criteria and scientific constraints.				
December/May	B1.2g	Identify scientific tradeoffs in design decisions and choose among alternative solutions.				
November	B1.2h	Describe the distinctions between scientific theories, laws, hypotheses, and observations.				
December	B1.2i	Explain the progression of ideas and explanations that leads to science theories that are part of the current scientific consensus or core knowledge.				
December/May	B1.2j	Apply science principles or scientific data to anticipate effects of technological design decisions.				

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December	B1.2k	Analyze how science and society interact from a historical, political, economic, or social perspective.				
September	**Standard B2**	**ORGANIZATION AND DEVELOPMENT OF LIVING SYSTEMS**				
September	**StatementL2.p 1**	**Cells *(prerequisite)*** All organisms are composed of cells, from just one cell to many cells. Water accounts for more than two-thirds of the weight of a cell, which gives cells many of their properties. In multicellular organisms, specialized cells perform specialized functions. Organs and organ systems are composed of cells and function to serve the needs of organisms for food, air, and waste removal. The way in which cells function is similar in all living organisms. *(prerequisite)*				

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September	L2.p1A	Distinguish between living and nonliving systems. *(prerequisite)*				
September	L2.p1B	Explain the importance of both water and the element carbon to cells. *(prerequisite)*				
September	L2.p1C	Describe growth and development in terms of increase in cell number, cell size, and/or cell products. *(prerequisite)*				
September	L2.p1d	Explain how the systems in a multicellular organism work together to support the organism. *(prerequisite)*				
September	L2.p1E	Compare and contrast how different organisms accomplish similar functions (e.g., obtain oxygen for respiration, and excrete waste). *(prerequisite)*				

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September	**StatementL2.p 2**	**Cell Function** ***(prerequisite)*** Cells carry out the many functions needed to sustain life. They grow and divide, thereby producing more cells. Food is used to provide energy for the work that cells do and is a source of the molecular building blocks from which needed materials are assembled. *(prerequisite)*				

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September	L2.p2A	Describe how organisms sustain life by obtaining, transporting, transforming, releasing, and eliminating matter and energy. *(prerequisite)*		active transport bacteria biological evolution cell function cell membrane cell nucleus cell organelle cell wall cellular differentiation chloroplast chromosome cytoplasm diffusion DNA (deoxyribonucleic acid) eukaryote Golgi apparatus mitochondrion nucleus nucleated cell organelle osmosis photosynthesizing organism prokaryote protein ribosome storage of genetic information transport of cell materials vacuole virus		
September	L2.p2B	Describe the effect of limiting food to developing cells. *(prerequisite)*				

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November	**StatementL2.p3**	**Plants as Producers (prerequisite)** Plants are producers; they use the energy from light to make sugar molecules from the atoms of carbon dioxide and water. Plants use these sugars, along with minerals from the soil, to form fats, proteins, and carbohydrates. This food can be used immediately, incorporated into the cells of a plant as the plant grows, or stored for later use. *(prerequisite)*				
September	L2.p3A	Explain the significance of carbon in organic molecules. *(prerequisite)*				
November	L2.p3B	Explain the origins of plant mass. *(prerequisite)*				
November	L2.p3C	Predict what would happen to plants growing in low carbon dioxide atmospheres. *(prerequisite)*				

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November	L2.p3D	Explain how the roots of specific plants grow. *(prerequisite)*				
November	**StatementL2.p 4**	**Animals as Consumers *(prerequisite)*** All animals, including humans, are consumers; they obtain food by eating other organisms or their products. Consumers break down the structures of the organisms they eat to obtain the materials they need to grow and function. Decomposers, including bacteria and fungi, use dead organisms or their products for food. *(prerequisite)*				
October	L2.p4A	Classify different organisms based on how they obtain energy for growth and development. *(prerequisite)*				
September	L2.p4B	Explain how an organism obtains energy from the food it consumes. *(prerequisite)*				

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September	**StatementL2.p5**	**Common Elements** ***(prerequisite)*** Living systems are made of complex molecules that consist mostly of a few elements, especially carbon, hydrogen, oxygen, nitrogen, and phosphorous. *(prerequisite)*				
September	L2.p5A	Recognize the six most common elements in organic molecules (C, H, N, O, P, S). *(prerequisite)*				
September	L2.p5B	Identify the most common complex molecules that make up living organisms. *(prerequisite)*				
September	L2.p5C	Predict what would happen if essential elements were withheld from developing cells. *(prerequisite)*				

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November	**StatementB2.1**	**Transformation of Matter and Energy in Cells** In multicellular organisms, cells are specialized to carry out specific functions such as transport, reproduction, or energy transformation.		ATP carbohydrate catalyst chemical bond covalent bonds DNA (deoxyribonucleic acid) dehydration element enzyme hemoglobin high energy bonds hormone hydrolysis lipid molecular energy nucleic acid protein protein structure polymers RNA (ribonucleic acid) substrate		
November	B2.1A	Explain how cells transform energy (ultimately obtained from the sun) from one form to another through the processes of photosynthesis and respiration. Identify the reactants and products in the general reaction of photosynthesis.				
November	B2.1B	Compare and contrast the transformation of matter and energy during photosynthesis and respiration.				

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January	B2.1C	Explain cell division, growth, and development as a consequence of an increase in cell number, cell size, and/ or cell products.				
January	**StatementB2.1x**	**Cell Differentiation** Following fertilization, cell division produces a small cluster of cells that then differentiate by appearance and function to form the basic tissues of an embryo.		anatomical characteristic cell function cell organelle cellular differentiation cellular waste disposal gills lungs membranes natural selection nitrogenous waste structural specialization		
December	B2.1d	Describe how, through cell division, cells can become specialized for specific function.				
January	B2.1e	Predict what would happen if the cells from one part of a developing embryo were transplanted to another part of the embryo.				

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September	**StatementB2.2**	**Organic Molecules** There are four major categories of organic molecules that make up living systems: carbohydrates, fats, proteins, and nucleic acids.				
September	B2.2A	Explain how carbon can join to other carbon atoms in chains and rings to form large and complex molecules.				
September	B2.2B	Recognize the six most common elements in organic molecules (C, H, N, O, P, S).				
September	B2.2C	Describe the composition of the four major categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids).				
September	B2.2D	Explain the general structure and primary functions of the major complex organic molecules that compose living organisms.				

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September	B2.2E	Describe how dehydration and hydrolysis relate to organic molecules.				
September	**StatementB2.2x**	**Proteins** Protein molecules are long, usually folded chains composed mostly of amino acids and are made of C, H, O, and N. Protein molecules assemble fats and carbohydrates; they function as enzymes, structural components, and hormones. The function of each protein molecule depends on its specific sequence of amino acids and the shape of the molecule.				
September	B2.2f	Explain the role of enzymes and other proteins in biochemical functions (e.g., the protein hemoglobin carries oxygen in some organisms, digestive enzymes, and hormones).				
May	B2.2g	Propose how moving an organism to a new environment May influence its ability to survive and predict the possible impact of this type of transfer.				

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September	**StatementB2.3**	**Maintaining Environmental Stability** The internal environment of living things must remain relatively constant. Many systems work together to maintain stability. Stability is challenged by changing physical, chemical, and environmental conditions as well as the presence of disease agents.		behavioral response disease agents equilibrium homeostasis hormone neuron pH physiological change regulatory response		
September	B2.3A	Describe how cells function in a narrow range of physical conditions, such as temperature and pH (acidity), to perform life functions.				
September	B2.3B	Describe how the maintenance of a relatively stable internal environment is required for the continuation of life.				
March	B2.3C	Explain how stability is challenged by changing physical, chemical, and environmental conditions as well as the presence of disease agents.				
March	**StatementB2.3x**	**Homeostasis** The internal environment of living things must remain relatively constant. Many systems work together to maintain homeostasis. When homeostasis is lost, death occurs.				

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March	B2.3d	Identify the general functions of the major systems of the human body (digestion, respiration, reproduction, circulation, excretion, protection from disease, and movement, control, and coordination) and describe ways that these systems interact with each other.				
March	B2.3e	Describe how human body systems maintain relatively constant internal conditions (temperature, acidity, and blood sugar).				
March	B2.3f	Explain how human organ systems help maintain human health.				
March	B2.3g	Compare the structure and function of a human body system or subsystem to a nonliving system (e.g., human joints to hinges, enzyme and substrate to interlocking puzzle pieces).				

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October	**StatementB2.4**	**Cell Specialization** In multicellular organisms, specialized cells perform specialized functions. Organs and organ systems are composed of cells and function to serve the needs of cells for food, air, and waste removal. The way in which cells function is similar in all living organisms.		breakdown of food molecules cell division cell function cell organelle cellular communication cellular differentiation cellular energy conversion cellular regulation cellular response cellular waste disposal differentiation embryo formation environmental influence enzyme gene combinations gene expression homeostasis metamorphosis neuron neurotransmitter recombination of genes sexual reproduction substrate transplantation		
October /April	B2.4A	Explain that living things can be classified based on structural, embryological, and molecular (relatedness of DNA sequence) evidence.				

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April	B2.4B	Describe how various organisms have developed different specializations to accomplish a particular function and yet the end result is the same (e.g., excreting nitrogenous wastes in animals, obtaining oxygen for respiration).				
April	B2.4C	Explain how different organisms accomplish the same result using different structural specializations (gills vs. lungs vs. membranes).		anatomical characteristic cell function cell organelle cellular differentiation cellular waste disposal gills lungs membranes natural selection nitrogenous waste structural specialization		

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April	B2.4d	Analyze the relationships among organisms based on their shared physical, biochemical, genetic, and cellular characteristics and functional processes.		breakdown of food molecules cell division cell function cell organelle cellular communication cellular differentiation cellular energy conversion cellular regulation cellular response cellular waste disposal differentiation embryo formation environmental influence enzyme gene combinations gene expression homeostasis metamorphosis neuron neurotransmitter recombination of genes sexual reproduction substrate transplantation		

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November	B2.4e	Explain how cellular respiration is important for the production of ATP (build on aerobic vs. anaerobic).		aerobic anaerobic ATP breakdown of food molecules cellular respiration cellular energy conversion chloroplast enzyme mitochondrion molecular energy photosynthesis potential energy product reactant transforming matter and/or energy		
September	B2.4f	Recognize and describe that both living and nonliving things are composed of compounds, which are themselves made up of elements joined by energy containing bonds, such as those in ATP.				
October	B2.4g	Explain that some structures in the modern eukaryotic cell developed from early prokaryotes, such as mitochondria, and in plants, chloroplasts.				
October	B2.4h	Describe the structures of viruses and bacteria.				

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October	B2.4i	Recognize that while viruses lack cellular structure, they have the genetic material to invade living cells.				
September	**StatementB2.5**	**Living Organism Composition** All living or once-living organisms are composed of carbohydrates, lipids, proteins, and nucleic acids. Carbohydrates and lipids contain many carbon-hydrogen bonds that also store energy.				
September	B2.5A	Recognize and explain that macromolecules such as lipids contain high energy bonds.				
October	B2.5B	Explain how major systems and processes work together in animals and plants, including relationships between organelles, cells, tissues, organs, organ systems, and organisms. Relate these to molecular functions.				
October	B2.5C	Describe how energy is transferred and transformed from the Sun to energy-rich molecules during photosynthesis.				

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October	B2.5D	Describe how individual cells break down energy-rich molecules to provide energy for cell functions.				
November /March	**StatementB2.5x**	**Energy Transfer** All living or once-living organisms are composed of carbohydrates, lipids, proteins, and nucleic acids. Carbohydrates and lipids contain many carbon-hydrogen bonds that also store energy. However, that energy must be transferred to ATP (adenosine triphosphate) to be usable by the cell.				
November	B2.5e	Explain the interrelated nature of photosynthesis and cellular respiration in terms of ATP synthesis and degradation.				
October	B2.5f	Relate plant structures and functions to the process of photosynthesis and respiration.				
October	B2.5g	Compare and contrast plant and animal cells.				

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October	B2.5h	Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, and active transport).				
October	B2.5i	Relate cell parts/organelles to their function.				
March	**StatementB2.6x**	**Internal/External Cell Regulation** Cellular processes are regulated both internally and externally by environments in which cells exist, including local environments that lead to cell differentiation during the development of multicellular organisms. During the development of complex multicellular organisms, cell differentiation is regulated through the expression of different genes.				
March	B2.6a	Explain that the regulatory and behavioral responses of an organism to external stimuli occur in order to maintain both short- and long-term equilibrium.		behavioral response disease agents equilibrium homeostasis hormone neuron pH physiological change regulatory response		

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March	B2.r6b	Explain that complex interactions among the different kinds of molecules in the cell cause distinct cycles of activities, such as growth and division. Note that cell behavior can also be affected by molecules from other parts of the organism, such as hormones. *(recommended)*				
March	B2.r6c	Recognize and explain that communication and/or interaction are required between cells to coordinate their diverse activities. *(recommended)*				
October	B2.r6d	Explain how higher levels of organization result from specific complex interactions of smaller units and that their maintenance requires a constant input of energy as well as new material. *(recommended)*				
March	B2.r6e	Analyze the body's response to medical interventions such as organ transplants, medicines, and inoculations. *(recommended)*				
	Standard B3	**INTERDEPENDENCE OF LIVING SYSTEMS AND THE ENVIRONMENT**				

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October	**StatementL3.p 1**	**Populations, Communities, and Ecosystems** ***(prerequisite)*** Organisms of one species form a population. Populations of different organisms interact and form communities. Living communities and the nonliving factors that interact with them form ecosystems. *(prerequisite)*		abiotic components of ecosystems biological molecule breakdown of food molecules carbon carbon cycle carbon dioxide cellular energy conversion cellular respiration chemical bond chemical organization of organisms consumer energy requirements of living systems flow of energy flow of matter nitrogen cycle organic compound organic compound synthesis organic matter photosynthesizing organism producer product reactant recombination of chemical elements release of energy transforming matter and/or energy transporting matter and/or energy trophic level		

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October	L3.p1A	Provide examples of a population, community, and ecosystem. *(prerequisite)*				
October	**StatementL3.p 2**	**L3.p2 Relationships Among Organisms** ***(prerequisite)*** Two types of organisms May interact with one another in several ways; they May be in a producer/consumer, predator/ prey, or parasite/host relationship. Or one organism May scavenge or decompose another. Relationships May be competitive or mutually beneficial. Some species have become so adapted to each other that neither could survive without the other. *(prerequisite)*				
October	L3.p2A	Describe common relationships among organisms and provide examples of producer/consumer, predator/ prey, or parasite/host relationship. *(prerequisite)*				

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October	L3.p2B	Describe common ecological relationships between and among species and their environments (competition, territory, carrying capacity, natural balance, population, dependence, survival, and other biotic and abiotic factors). *(prerequisite)*				
October	L3.p2C	Describe the role of decomposers in the transfer of energy in an ecosystem. *(prerequisite)*				
October	L3.p2D	Explain how two organisms can be mutually beneficial and how that can lead to interdependency. *(prerequisite)*				
October	**StatementL3.p3**	**Factors Influencing Ecosystems *(prerequisite)*** The number of organisms and populations an ecosystem can support depends on the biotic resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. *(prerequisite)*				

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October	L3.p3A	Identify the factors in an ecosystem that influence fluctuations in population size. *(prerequisite)*		abiotic component of the ecosystem biological adaptations carrying capacity ecosystem stability equilibrium of ecosystems exponential growth global warming greenhouse effect human modification of the ecosystem population dynamics reproductive capacity succession		
October	L3.p3B	Distinguish between the living (biotic) and nonliving (abiotic) components of an ecosystem. *(prerequisite)*				
October	L3.p3C	Explain how biotic and abiotic factors cycle in an ecosystem (water, carbon, oxygen, and nitrogen). *(prerequisite)*				
October	L3.p3D	Predict how changes in one population might affect other populations based upon their relationships in a food web. *(prerequisite)*				

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October	**StatementL3.p 4**	**Human Impact on Ecosystems *(prerequisite)*** All organisms cause changes in their environments. Some of these changes are detrimental, whereas others are beneficial. *(prerequisite)*				
October	L3.p4A	Recognize that, and describe how, human beings are part of Earth's ecosystems. Note that human activities can deliberately or inadvertently alter the equilibrium in ecosystems. *(prerequisite)*				
October	**StatementB3.1**	**Photosynthesis and Respiration** Organisms acquire their energy directly or indirectly from sunlight. Plants capture the Sun's energy and use it to convert carbon dioxide and water to sugar and oxygen through the process of photosynthesis. Through the process of cellular respiration, animals are able to release the energy stored in the molecules produced by plants and use it for cellular processes, producing carbon dioxide and water.				
October	B3.1A	Describe how organisms acquire energy directly or indirectly from sunlight.				

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November	B3.1B	Illustrate and describe the energy conversions that occur during photosynthesis and respiration.				
October	B3.1C	Recognize the equations for photosynthesis and respiration and identify the reactants and products for both.				
December	B3.1D	Explain how living organisms gain and use mass through the processes of photosynthesis and respiration.				
October	B3.1e	Write the chemical equation for photosynthesis and cellular respiration and explain in words what they mean.				
December	B3.1f	Summarize the process of photosynthesis.				

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April	**StatementB3.2**	**Ecosystems** The chemical elements that make up the molecules of living things pass through food webs and are combined and recombined in different ways. At each link in an ecosystem, some energy is stored in newly made structures, but much is dissipated into the environment as heat. Continual input of energy from sunlight keeps the process going.				
April	B3.2A	Identify how energy is stored in an ecosystem.				
April	B3.2B	Describe energy transfer through an ecosystem, accounting for energy lost to the environment as heat.				
April	B3.2C	Draw the flow of energy through an ecosystem. Predict changes in the food web when one or more organisms are removed.				

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December	**StatementB3.3**	**Element Recombination** As matter cycles and energy flows through different levels of organization of living systems—cells, organs, organisms, and communities—and between living systems and the physical environment, chemical elements are recombined in different ways. Each recombination results in storage and dissipation of energy into the environment as heat. Matter and energy are conserved in each change.				
October	B3.3A	Use a food web to identify and distinguish producers, consumers, and decomposers and explain the transfer of energy through trophic levels.				
October/Earth Science	B3.3b	Describe environmental processes (e.g., the carbon and nitrogen cycles) and their role in processing matter crucial for sustaining life.				

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April	**StatementB3.4**	**Changes in Ecosystems** Although the interrelationships and interdependence of organisms May generate biological communities in ecosystems that are stable for hundreds or thousands of years, ecosystems always change when climate changes or when one or more new species appear as a result of migration or local evolution. The impact of the human species has major consequences for other species.				
April	B3.4A	Describe ecosystem stability. Understand that if a disaster such as flood or fire occurs, the damaged ecosystem is likely to recover in stages of succession that eventually result in a system similar to the original one.				
April	B3.4B	Recognize and describe that a great diversity of species increases the chance that at least some living organisms will survive in the face of cataclysmic changes in the environment.				
April	B3.4C	Examine the negative impact of human activities.				

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April	**StatementB3.4x**	**Human Impact** Humans can have tremendous impact on the environment. Sometimes their impact is beneficial, and sometimes it is detrimental.				
April	B3.4d	Describe the greenhouse effect and list possible causes.				
April	B3.4e	List the possible causes and consequences of global warming.				
November	**StatementB3.5**	**Populations** Populations of living things increase and decrease in size as they interact with other populations and with the environment. The rate of change is dependent upon relative birth and death rates.				
November	B3.5A	Graph changes in population growth, given a data table.				

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November	B3.5B	Explain the influences that affect population growth.				
November	B3.5C	Predict the consequences of an invading organism on the survival of other organisms.				
November	**StatementB3.5x**	**Environmental Factors** The shape of population growth curves vary with the type of organism and environmental conditions, such as availability of nutrients and space. As the population increases and resources become more scarce, the population usually stabilizes at the carrying capacity of that environment.				
November	B3.5d	Describe different reproductive strategies employed by various organisms and explain their advantages and disadvantages.				
April	B3.5e	Recognize that and describe how the physical or chemical environment May influence the rate, extent, and nature of population dynamics within ecosystems.				

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November	B3.5f	Graph an example of exponential growth. Then show the population leveling off at the carrying capacity of the environment.				
November	B3.5g	Diagram and describe the stages of the life cycle for a human disease-causing organism. *(recommended)*				
	Standard B4	**GENETICS**				
November	**L4.p1**	**Reproduction** ***(prerequisite)*** Reproduction is a characteristic of all living systems; because no individual organism lives forever, reproduction is essential to the continuation of every species. Some organisms reproduce asexually. Other organisms reproduce sexually. *(prerequisite)*				
November	L4.p1A	Compare and contrast the differences between sexual and asexual reproduction. *(prerequisite)*				

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November	L4.p1B	Discuss the advantages and disadvantages of sexual vs. asexual reproduction. *(prerequisite)*				
December	**StatementL4.p2**	**Heredity and Environment (prerequisite)** The characteristics of organisms are influenced by heredity and environment. For some characteristics, inheritance is more important. For other characteristics, interactions with the environment are more important. *(prerequisite)*				
December	L4.p2A	Explain that the traits of an individual are influenced by both the environment and the genetics of the individual. Acquired traits are not inherited; only genetic traits are inherited. *(prerequisite)*				

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December	**StatementB4.1**	**Genetics and Inherited Traits** Hereditary information is contained in genes, located in the chromosomes of each cell. Cells contain many thousands of different genes. One or many genes can determine an inherited trait of an individual, and a single gene can influence more than one trait. Before a cell divides, this genetic information must be copied and apportioned evenly into the daughter cells.		cancer carcinogenic chromosome chromosome pair crossing over deletion DNA replication diploid duplication of genes haploid gametes genetic variation jumping genes karyotype meiosis mitosis mutation new gene combinations progeny recombination of genetic material sex cell sex chromosomes		
December	B4.1A	Draw and label a homologous chromosome pair with heterozygous alleles highlighting a particular gene location.				
December	B4.1B	Explain that the information passed from parents to offspring is transmitted by means of genes that are coded in DNA molecules. These genes contain the information for the production of proteins.				

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December	B4.1c	Differentiate between dominant, recessive, codominant, polygenic, and sex-linked traits.				
December	B4.1d	Explain the genetic basis for Mendel's laws of segregation and independent assortment.				
December	B4.1e	Determine the genotype and phenotype of monohybrid crosses using a Punnett Square.				

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December	**StatementB4.2**	**DNA** The genetic information encoded in DNA molecules provides instructions for assembling protein molecules. Genes are segments of DNA molecules. Inserting, deleting, or substituting DNA segments can alter genes. An altered gene May be passed on to every cell that develops from it. The resulting features May help, harm, or have little or no effect on the offspring's success in its environment.		amino acid sequence anatomical characteristic biochemical characteristic biological adaptation cell nucleus chromosome complementary sequence degree of kinship DNA DNA molecule DNA sequence DNA subunit double helix enzyme evidence for unity among organisms gene genetic diversity genetic mutation genetic variation inherited trait messenger RNA molecular synthesis new gene combinations nucleated cell phylogenetics protein protein structure protein synthesis recombination of genetic material ribosome storage of genetic information transcription translation transfer RNA		

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December	B4.2A	Show that when mutations occur in sex cells, they can be passed on to offspring (inherited mutations), but if they occur in other cells, they can be passed on to descendant cells only (noninherited mutations).				
December	B4.2B	Recognize that every species has its own characteristic DNA sequence.				
December	B4.2C	Describe the structure and function of DNA.				
December	B4.2D	Predict the consequences that changes in the DNA composition of particular genes May have on an organism (e.g., sickle cell anemia, other).				
December	B4.2E	Propose possible effects (on the genes) of exposing an organism to radiation and toxic chemicals.				

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January	**StatementB4.2x**	**DNA, RNA, and Protein Synthesis** Protein synthesis begins with the information in a sequence of DNA bases being copied onto messenger RNA. This molecule moves from the nucleus to the ribosome in the cytoplasm where it is "read." Transfer RNA brings amino acids to the ribosome, where they are connected in the correct sequence to form a specific protein.		allele chromosome chromosome pair co-dominant traits DNA replication dominant trait gene encoding gene expression genetic diversity gene location genetic mutation genetic variation genotype heterozygous homologous chromosome human genetics independent assortment law of Segregation meiosis Mendelian genetics new gene combinations phenotype phylogenetics polygenic traits protein protein synthesis Punnett Square recessive traits recombination of genetic material sex cell sex chromosomes sex-linked traits shared characteristics storage of genetic information		

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January	B4.2f	Demonstrate how the genetic information in DNA molecules provides instructions for assembling protein molecules and that this is virtually the same mechanism for all life forms.				
January	B4.2g	Describe the processes of replication, transcription, and translation and how they relate to each other in molecular biology.				
January	B4.2h	Recognize that genetic engineering techniques provide great potential and responsibilities.				
January	B4.2i	Explain how recombinant DNA technology allows scientists to analyze the structure and function of genes. *(recommended)*				
January	**StatementB4.3**	**Cell Division — Mitosis and Meiosis** Sorting and recombination of genes in sexual reproduction results in a great variety of possible gene combinations from the offspring of any two parents.				

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January	B4.3A	Compare and contrast the processes of cell division (mitosis and meiosis), particularly as those processes relate to production of new cells and to passing on genetic information between generations.				
January	B4.3B	Explain why only mutations occurring in gametes (sex cells) can be passed on to offspring.				
January	B4.3C	Explain how it might be possible to identify genetic defects from just a karyotype of a few cells.				
January	B4.3d	Explain that the sorting and recombination of genes in sexual reproduction result in a great variety of possible gene combinations from the offspring of two parents.				
January	B4.3e	Recognize that genetic variation can occur from such processes as crossing over, jumping genes, and deletion and duplication of genes.				

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January	B4.3f	Predict how mutations May be transferred to progeny.				
January	B4.3g	Explain that cellular differentiation results from gene expression and/or environmental influence (e.g., metamorphosis, nutrition).				
January	**StatementB4.4x**	**Genetic Variation** Genetic variation is essential to biodiversity and the stability of a population. Genetic variation is ensured by the formation of gametes and their combination to form a zygote. Opportunities for genetic variation also occur during cell division when chromosomes exchange genetic material causing permanent changes in the DNA sequences of the chromosomes. Random mutations in DNA structure caused by the environment are another source of genetic variation.				

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January	B4.4a	Describe how inserting, deleting, or substituting DNA segments can alter a gene. Recognize that an altered gene May be passed on to every cell that develops from it and that the resulting features May help, harm, or have little or no effect on the offspring's success in its environment.				
February	B4.4b	Explain that gene mutation in a cell can result in uncontrolled cell division called cancer. Also know that exposure of cells to certain chemicals and radiation increases mutations and thus increases the chance of cancer.				
February	B4.4c	Explain how mutations in the DNA sequence of a gene May be silent or result in phenotypic change in an organism and in its offspring.				
February	**StatementB4.r5x**	**Recombinant DNA** Recombinant DNA technology allows scientists in the laboratory to combine the genes from different sources, sometimes different species, into a single DNA molecule. This manipulation of genes using bacterial plasmids has been used for many practical purposes including the mass production of chemicals and drugs. *(recommended)*				

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February	B4.r5a	Explain how recombinant DNA technology allows scientists to analyze the structure and function of genes. *(recommended)*				
February	B4.r5b	Evaluate the advantages and disadvantages of human manipulation of DNA. *(recommended)*				
	Standard B5	**EVOLUTION AND BIODIVERSITY**				

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April	**StatementL5.p1**	**Survival and Extinction** ***(prerequisite)*** Individual organisms with certain traits in particular environments are more likely than others to survive and have offspring. When an environment changes, the advantage or disadvantage of characteristics can change. Extinction of a species occurs when the environment changes and the characteristics of a species are insufficient to allow survival. Fossils indicate that many organisms that lived long ago are extinct. Extinction of species is common; most of the species that have lived on the Earth no longer exist. *(prerequisite)*		behavioral structures biodiversity biological evolution chance inherited variants comparative anatomy degree of kinship differential survival DNA DNA molecule embryonic stages of development evidence for the unity among organisms gene pool genetic drift genetic diversity genetic mutation genetic variation homologous structures molecular structures morphological structures natural selection origin of life phylogenetics recombination of genetic material speciation		
April	L5.p1A	Define a species and give examples. *(prerequisite)*				

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April	L5.p1B	Define a population and identify local populations. *(prerequisite)*				
April	L5.p1C	Explain how extinction removes genes from the gene pool. *(prerequisite)*				
April	L5.p1D	Explain the importance of the fossil record. *(prerequisite)*				
April	**StatementL5.p2**	**Classification** ***(prerequisite)*** Similarities among organisms are found in anatomical features, which can be used to infer the degree of relatedness among organisms. In classifying organisms, biologists consider details of internal and external structures to be more important than behavior or general appearance. *(prerequisite)*				

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April	L5.p2A	Explain, with examples, that ecology studies the varieties and interactions of living things across space while evolution studies the varieties and interactions of living things across time. *(prerequisite)*				
April	**StatementB5.1**	**Theory of Evolution** The theory of evolution provides a scientific explanation for the history of life on Earth as depicted in the fossil record and in the similarities evident within the diversity of existing organisms.				
April	B5.1A	Summarize the major concepts of natural selection (differential survival and reproduction of chance inherited variants, depending on environmental conditions).				
April	B5.1B	Describe how natural selection provides a mechanism for evolution.				
April	B5.1c	Summarize the relationships between present-day organisms and those that inhabited the Earth in the past (e.g., use fossil record, embryonic stages, homologous structures, chemical basis).				

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April	B5.1d	Explain how a new species or variety originates through he evolutionary process of natural selection.				
April	B5.1e	Explain how natural selection leads to organisms that are well suited for the environment (differential survival and reproduction of chance inherited variants, depending upon environmental conditions).				
April	B5.1f	Explain, using examples, how the fossil record, comparative anatomy, and other evidence supports the theory of evolution.				
May	B5.1g	Illustrate how genetic variation is preserved or eliminated from a population through natural selection (evolution) resulting in biodiversity.				
May	**StatementB5.2x**	**Molecular Evidence** Molecular evidence substantiates the anatomical evidence for evolution and provides additional detail about the sequence in which various lines of descents branched.				

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May	B5.2a	Describe species as reproductively distinct groups of organisms that can be classified based on morphological, behavioral, and molecular similarities.				
May	B5.2b	Explain that the degree of kinship between organisms or species can be estimated from the similarity of their DNA and protein sequences.				
May	B5.2c	Trace the relationship between environmental changes and changes in the gene pool, such as genetic drift and isolation of subpopulations.				
May	B5.r2d	Interpret a cladogram or phylogenetic tree showing evolutionary relationships among organisms. *(recommended)*				

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	StatementB5.3	**Natural Selection** Evolution is the consequence of natural selection, the interactions of (1) the potential for a population to increase its numbers, (2) the genetic variability of offspring due to mutation and recombination of genes, (3) a finite supply of the resources required for life, and (4) the ensuing selection from environmental pressure of those organisms better able to survive and leave offspring.				
May	B5.3A	Explain how natural selection acts on individuals, but it is populations that evolve. Relate genetic mutations and genetic variety produced by sexual reproduction to diversity within a given population.				
May	B5.3B	Describe the role of geographic isolation in speciation.				
May	B5.3C	Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms.				

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May	B5.3d	Explain how evolution through natural selection can result in changes in biodiversity.				
May	B5.3e	Explain how changes at the gene level are the foundation for changes in populations and eventually the formation of new species.				
February	B5.3f	Demonstrate and explain how biotechnology can improve a population and species.				

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NWEA Additional Vocabulary	
	absorption, air pollution, air quality, algae, amphibious, animal cell, anus, arthropod, ATP, biome, birth rate, bladder, blue-green algae, body system, carbon monoxide, cell membrane, change over time, chemical, chlorophyll, circulate, commodity, community, complete metamorphosis, consume, crustacean, cytoplasm, death rate, decompose, development, diet, digest, droplet, echinoderm, ecology, ecosystem, eliminate, embryo, evolution, excrete, exhale , fertilization, food supply, four-legged, fungi, generation, genetics, heart disease, hereditary information, heredity, inert, jellyfish, kidney, large intestine, life zone, liver, membrane, message, migrate, mollusk, mushroom, native, niche, nitrogen dioxide, nuclear membrane, osmosis, ovary, overpopulate, overweight, paramecia, pest, photosynthesis, pistil, pollen, pollination, pollutant, prairie dog, red blood cell, regulate, respiration, rodent, scale (skin), scales, skeletal system, skull, small intestine, smoking, social, source of energy, species, sperm, spore, stamen, succession, sugar, sulfur dioxide, symbiosis, synthesis, transport, trout, tube, umbilical cord, urinary bladder, uterus, vein, virus, web, yeast, yolk sac abdomen, antenna, backbone, bark, body part, body section, body segments, cell wall, cephalothorax, characteristic, circulatory system, classification, cold-blooded, constant, consumer, developmental sequence, digestion, digestive system, esophagus, exercise, experimentation, extinct, female, field, food chain, food web, four-chambered heart, habitat, hibernation, hide, host, hunger, hypothesize, inference, ingestion, internal, intestine, invertebrate, jointed leg, larva, muscular system, nervous system, nocturnal, nymph, obtain, organ, parasite, petal, petrification, plant cell, predator, prey, producer, protective coloration, pupa, rabbit, rate, relationship, remains, reproduce, reproductive system, respiratory, respiratory system, response, rest, scale, scatter, sea, seed coat, sewage, spinal cord, spines (bristles), stages of growth, system, thorax, vacuole, vertebrate, warm-blooded, waste, weather cycle, coelenterata, daughter cell, genetic structure, geotropism, germination, liverfluke, maturation, mineral content, nematoda, pioneer (plant), plastid, tundra anatomy, artery, arthropoda, atmospheric pollution, behavior, body fat, capillary, carbohydrate, cellulose, centriole, chromosome, cleavage, colony, conception, coniferous tree, conjugation, constitute, cross (genetic), crossing over, dominant, duplicate, environmental condition, enzyme, excretory system, exoskeleton, external appendage, fat, fertilized, fin, flatworm, gastrulation, gene, gene frequency, gene pool, genetic material, genotype, gestation, implantation, infectious disease, inherited, interphase, interrelationship, involuntary responses, lichen, lipids, live birth, lubricate, lymphatic system, meiosis, microorganism, mitosis, moisture, moss, mutation, natural resources, nucleic acid, nucleolus, oak, overcrowding, ovulation, ovule, phenotype, physical environment, pigment, plasma, plasma membrane, platelet, population growth, prehistoric, protoplasm, protozoa, recessive, recycling, reduction division, renewable resource, section, selective breeding, sex, single-celled, sponge, starch, stigma, stinging cell, stress, synthesize, taxonomy, trait, white blood cell, xylem (plant) cell wall, abiotic factor, additive, adrenalin, algal bloom, alternative energy source, amino acid, amoeba, artificial selection, axon, bacteria of decay, biologist, blood sugar level, brain, breeder, cellular respiration, cellular structure, chitin, cilia, class, class (taxonomy), conservation biologist, conserve, Darwin, DDT, deletion, diffusion, electrochemical impulse, energy releasing process, estrogen, family, fermentation, flagella, follicle-stimulating hormone, genus, grassland, guard cell, holdfast, hormone, inorganic, insulin, inversion, kingdom, Leeuwenhoek, life span, Linnaeus, locomotion, natural selection, neuron, neurotransmitter, pancreas, parathormone, Pasteur, phagocytosis, phototropism, pinocytosis, plasmodium, protein synthesis, protist, pseudopod, rate of entry, Schwann, specialization, specimen, stimulus, stomate, subdivision, substitution, substratum, synapse, translocation, transportation, vestigial structure