Marking Period: 1st six weeks
Days: 10
Reporting Category/Strand: Life Science

SOL LS 6	The student will investigate and understand that organisms within an ecosystem are dependent on one another and on nonliving components of the environment. Key concepts include a) the carbon, water, and nitrogen cycles; b) interactions resulting in a flow of energy and matter throughout the system; c) complex relationships within terrestrial, freshwater, and marine ecosystems; and d) energy flow in food webs and energy pyramids.
Essential Knowledge/Skills/Understandings	• observe and identify common organisms in ecosystems and collect, record, and chart data concerning the interactions of these organisms (from observations and print and electronic resources). • classify organisms found in local ecosystems as producers or first-, second-, or third-order consumers. Design and construct models of food webs with these organisms. • observe local ecosystems and identify, measure, and classify the living and nonliving components. • identify examples of interdependence in terrestrial, freshwater, and marine ecosystems. • determine the relationship between a population's position in a food web and its size. • apply the concepts of food chains, food webs, and energy pyramids to analyze how energy and matter flow through an ecosystem. • design an investigation from a testable question related to food webs. The investigation may be a complete experimental design or may focus on systematic observation, description, measurement, and/or data collection and analysis. • analyze and critique the experimental design of basic investigations related to food webs. • The amount of energy available to each successive trophic level (producer, first-order consumer, second-order consumer, third-order consumer) decreases. This can be modeled through an energy pyramid, in which the producers provide the broad base that supports the other interactions in the system.
Essential Questions	Predict the effect of population changes of the food web of a community. Differentiate between the types of symbiosis and list examples of each.
Primary Resources	Around and around you go; where you'l stop nobody knows. the Carbon, Nitrogen and Water Cycles. what is a pyramid of energy?

Essential Vocabulary	• **interdependence** • **physical environment** • **aquatic** • **terrestrial, freshwater, marine (oceans)** • **food webs, chain, and pyramids** • **environment** • **decomposer** • **herbivore,omnivore** • **bacteria, fungi** • **niche** • **carbon, water and nitrogen cycles** • **flow of energy and matter** • **photosynthesis** • **organism** • **trophic level** • **first, second and third order consumers** • **population, ecosystem**

Marking Period: 1st six weeks
Days: 10

Reporting Category/Strand:

SOL 8	The student will investigate and understand interactions among populations in a biological community. Key concepts include a) the relationships among producers, consumers, and decomposers in food webs; b) the relationship between predators and prey; c) competition and cooperation; d) symbiotic relationships; and e) niches.

Essential Knowledge/Skills/Understandings	• identify the populations of producers, consumers, and decomposers and describe the roles they play in their communities. • interpret, analyze, and evaluate data from systematic studies and experiments concerning the interactions of populations in an ecosystem. • predict the effect of population changes on the food web of a community.. • generate predictions based on graphically represented data of competition and cooperation between populations. • infer the niche of organisms from their physical characteristics. • design an investigation from a testable question related to interactions among populations. The investigation may be a complete experimental design or may focus on systematic observation, description, measurement, and/or data collection and analysis. identify the populations of producers, consumers, and decomposers and describe the roles they play in their communities.
Essential Questions	- Infer the niche of organisms from their physical characteristics. - Predict the effect of large scale changes on ecosystems, communities, populations, and organisms (fire, drought, flood, etc. on populations.
Primary Resources	
Essential Vocabulary	• **populations** • **community** • **predator, prey** • **competition, cooperation** • **symbiotic relationships, commensalism, mutualism, parasitism (parasite, host)** • **population** • **species** • **niche**

Marking Period: 1st six weeks
Days: 10
Reporting Category/Strand:

SOL 5	The student will investigate and understand the basic physical and chemical processes of photosynthesis and its importance to plant and animal life. Key concepts include a) energy transfer between sunlight and chlorophyll; b) transformation of water and carbon dioxide into sugar and oxygen; and c) photosynthesis as the foundation of virtually all food webs.
Essential Knowledge/Skills/Understandings	• identify and describe the cellular organelles involved in the process of photosynthesis. • explain how organisms utilize the energy stored from the products of photosynthesis. • compare and contrast the processes of photosynthesis and cellular respiration. • relate the importance of photosynthesis to the role of producers as the foundation of food webs. • design an investigation from a testable question related to photosynthesis. The investigation may be a complete experimental design or may focus on systematic observation, description, measurement, and/or data collection and analysis.
Essential Questions	Why are cycles important to living things? What roles do bacteria play in the nitrogen cycle?
Primary Resources	What is Photosynthesis? Center for Bioenergy & Photosynthesis. Arizona State University
Essential Vocabulary	• **photosynthesis** • **chlorophyll** • **carbon dioxide** • **glucose sugar** • **cellular respiration** • **organelles**

Marking Period: 2nd six weeks
Days: 14
Reporting Category/Strand:

SOL 9	The student will investigate and understand how organisms adapt to biotic and abiotic factors in an ecosystem. Key concepts include a) differences between ecosystems and biomes; b) characteristics of land, marine, and freshwater ecosystems; and c) adaptations that enable organisms to survive within a specific ecosystem.
Essential Knowledge/Skills/Understandings	• differentiate between ecosystems and biomes. • recognize and give examples of major biomes: desert, forest, grassland, and tundra. • compare and contrast the biotic and abiotic characteristics of land, marine, and freshwater ecosystems. • analyze and describe how specific adaptations enable organisms to survive in a particular ecosystem. • design an investigation from a testable question related to how specific adaptations of organisms allow them to survive in the presence of the biotic and abiotic factors in an ecosystem. The investigation may be a complete
Essential Questions	- Differentiate between ecosystems, communities, populations, and organisms. - Describe examples of specific adaptaations that organisms have which enabe them to survive in a particular ecosystem - Compare and contrast the biotic and abiotic characteristics of land, marine, and freshwater ecosystems.
Primary Resources	
Essential Vocabulary	● **biotic, abiotic** ● **biomes desert, grassland, rainforest, forest, wetland (marshland, swamp)** ● **adaptations** ● **climate**

Marking Period: 2nd six weeks
Days: 13
Reporting Category/Strand: Life science

SOL 7	The student will investigate and understand that interactions exist among members of a population. Key concepts include a) competition, cooperation, social hierarchy, territorial imperative; and b) influence of behavior on a population.
Essential Knowledge/Skills/Understandings	differentiate between the needs of the individual and the needs of a population. • interpret, analyze, and evaluate data from systematic studies and experiments concerning the interactions among members of a population. • determine the relationship between a population's position in a food web and the types of interactions seen among the individuals of the population. • observe and identify populations in ecosystems and collect, record, chart, and interpret data concerning the interactions of these organisms (from observations and print and electronic resources). • categorize behaviors as examples of competition,
Essential Questions	- Interpret data from a graph concerning the interactions of organisms in a pond. - List examples of animals competition - List examples of plants competetition
Primary Resources	
Essential Vocabulary	● **social hierarchy** ● **territory**

Marking Period: 2nd six weeks
Days: 2

Reporting Category/Strand: Life Science

SOL 10	The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic, change over time, and respond to daily, seasonal, and long-term changes in their environment. Key concepts include a) phototropism, hibernation, and dormancy; b) factors that increase or decrease population size; and c) eutrophication, climate changes, and catastrophic disturbances.
Essential Knowledge/Skills/Understandings	• relate the responses of organisms to daily, seasonal, or long-term events. • differentiate between ecosystems, communities, populations, and organisms. • predict the effect of climate change on ecosystems, communities, populations, and organisms. • predict the effect of eutrophication on ecosystems, communities, populations, and organisms. • compare and contrast the factors that increase or decrease population size. • classify the various types of changes that occur over time in ecosystems, communities, populations, and organisms, as long term, short term, or seasonal. • design an investigation from a testable question related to change over time in ecosystems, communities, populations, or organisms. The investigation may be a complete experimental design or may focus on systematic observation, description, measurement, and/or data collection and analysis. • analyze and critique the experimental design of basic investigations related to change over time in ecosystems, communities, populations, and organisms.
Essential Questions	- Predict the effect of climate change on communities. - Describe the steps in eutrophication.
Primary Resources	Adaptation to the Cold Gateway Antarctica Animal Diversity Web University of Michigan Museum of Zoology
Essential Vocabulary	• **dynamic** • **daily, seasonal, long-term changes** • **phototropism**

	• **hibernation** • **dormancy** • **eutrophication** • **catastrophic disturbances** • **lowered metabolism**

Marking Period: 2nd six weeks
Days: 13
Reporting Category/Strand:

SOL 11	The student will investigate and understand the relationships between ecosystem dynamics and human activity. Key concepts include a) food production and harvest; b) change in habitat size, quality, or structure; c) change in species competition; d) population disturbances and factors that threaten or enhance species survival; and e) environmental issues.
Essential Knowledge/Skills/Understandings	• describe the relationship between human food harvest and the ecosystem.

	• debate the pros and cons of human land use versus ecosystem stability. • compare and contrast population disturbances that threaten and those that enhance species survival. • describe ways that human interaction has altered habitats positively and negatively. • observe the effect of human interaction in local ecosystems and collect, record, chart, and interpret data concerning the effect of interaction (from observations and print and electronic resources). • design an investigation from a testable question related to the relationships between ecosystem dynamics and human activity. The investigation may be a complete experimental design or may focus on systematic observation, description, measurement, and/or data collection and analysis. • analyze and critique the experimental design of basic investigations related to the relationships between ecosystem dynamics and human activity.

Essential Questions	- Name three ways that humans pollute water and explain ways to prevent these three problems. -Compare and contrast population disturbances that threaten and those that enhance species survival.
Primary Resources	
Essential Vocabulary	● **dynamic** ● **environmental issues air quality, energy production,waste management** ● **natural resources** ● **habitat** ● **ripple effect**

Marking Period: 3rd six weeks
Days: 15
Reporting Category/Strand: Life Science

SOL LS 13	The student will investigate and understand that populations of organisms change over time. Key concepts include a) the relationships of mutation, adaptation, natural selection, and extinction; b) evidence of evolution of different species in the fossil record; and c) how environmental influences, as well as genetic variation, can lead to diversity of organisms.
Essential Knowledge/Skills/Understandings	• interpret data from simulations that demonstrate selection for a trait belonging to species in various environments. • describe how changes in the environment can bring about changes in a species (adaptation, extinction) through natural selection. • describe and explain how fossils are records of organisms and events in Earth's history. • explain the evidence for evolution from a variety of sources of scientific data. • explain how genetic variations in offspring, which lead to variations in successive generations, can result from the same two parents. • analyze and evaluate data from investigations on variations within a local population. • explain how environmental influences, as well as genetic variation, can lead to diversity of organisms.
Essential Questions	-Look at a picture of a polar bear and list as many examples of adaptations as possible. - Describe how genetic variations help animals adapt to their environment.
Primary Resources	
Essential Vocabulary	● **mutation,** ● **adaptations,** ● **natural selections,** ● **extinction** ● **evolution** ● **variation**

Marking Period: 3rd

Days: 16
Reporting Category/Strand:

SOL 1 a-j	The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which a) data are organized into tables showing repeated trials and means; b) a classification system is developed based on multiple attributes; c) triple beam and electronic balances, thermometers, metric rulers, graduated cylinders, and probeware are used to gather data; d) models and simulations are constructed and used to illustrate and explain phenomena; e) sources of experimental error are identified; f) dependent variables, independent variables, and constants are identified; g) variables are controlled to test hypotheses and trials are repeated; h) data are organized, communicated through graphical representation, interpreted, and used to make predictions; i) patterns are identified in data and are interpreted and evaluated; and j) current applications are used to reinforce life science concepts.
Essential Knowledge/Skills/Understandings	• make connections between the components of the nature of science and their investigations and the greater body of scientific knowledge and research. • design a data table to organize all components of an investigation in a meaningful way. • develop and use a classification system that uses numerous attributes to organize information and discern patterns. • select and use appropriate tools and techniques for collecting qualitative and quantitative data in classroom and field investigations. • create and use mental and physical models (including simulations) as ways to visualize explanations of ideas and phenomena. • identify potential sources of error in the design of an experiment. • evaluate the design of an experiment and the events that occur during an investigation to determine which factors may affect the results of the experiment. This requires students to examine the experimental procedure and decide where or if they have made mistakes. • identify what is deliberately changed in the experiment and what is to be measured as the dependent variable.
Essential Questions	- Design an experiment to determine the effect of “acid rain” on the height of plants.

	- Graph the results of the “acid rain” experiment.
Primary Resources	
Essential Vocabulary	

Marking Period: 4th
Days: 5
Reporting Category/Strand:

SOL 2	LS.2 The student will investigate and understand that all living things are composed of cells. Key concepts include a) cell structure and organelles; b) similarities and differences between plant and animal cells; c) development of cell theory; and d) cell division.
Essential Knowledge/Skills/Understandings	• distinguish among the following: cell membrane, cytoplasm, nucleus, cell wall, vacuole, mitochondrion, endoplasmic reticulum, and chloroplast. • correlate the structures of cell organelles with their functions. • compare and contrast examples of plant and animal cells, using the light microscope and images obtained from other microscopes. • describe and sequence the major points in the development of the cell theory. • identify the three components of the cell theory. † • sequence the steps in the cell cycle, including the phases of mitosis. • differentiate between the purpose of mitosis and meiosis. • design an investigation from a testable question related to animal and plant cells. The investigation may be a complete experimental design or may focus on systematic observation, description, measurement, and/or data collection and analysis. An example of such a question is: “Do onion cells vary in shape or structure depending on where they are found in the plant?”
Essential Questions	- Compare and contrast plant and animal cells. - Differentiate between mitosis and meiosis.
Primary Resources	The Biology Project: an online interactive resource for learning Biology

	Plant, Animal, and Bacteria Cell Models. Cells Alive!
Essential Vocabulary	

Marking Period: 4th six weeks
Days: 5
Reporting Category/Strand:

SOL 3	The student will investigate and understand that living things show patterns of cellular organization. Key concepts include a) cells, tissues, organs, and systems; and b) patterns of cellular organization and their relationship to life processes in living things.
Essential Knowledge/Skills/Understandings	• explain the relationship among cells, tissue, organs, and organ systems. • differentiate between unicellular organisms and multicellular organisms and name common examples of each. • compare and contrast how unicellular and multicellular organisms perform various life functions. This includes the application of knowledge about systems in organisms. • explain the role that each life function serves for an organism: ingestion, digestion and removal of waste, stimulus response, growth and repair, gas exchange, and reproduction. • explain that there is a specific range or continuum of conditions that will meet the needs of organisms. • model how materials move into and out of cells in the processes of osmosis, diffusion, and selective permeability. This includes creating and interpreting three-dimensional models and/or illustrations demonstrating the processes involved. Students should be able to analyze the components of these models and diagrams and communicate their observations and conclusions. • create plausible hypotheses about the effects that changes in available materials might have on particular life processes in plants and in animals. • conduct basic investigations related to understanding cellular organization, with emphasis on

	observations of cells and tissue. This investigation should focus on the skills developed in LS.1.
Essential Questions	- Compare and contrast how unicellular and multicellular organisms perform various life functions describe the basic life functions of an organism , including respiration, waste removal, growth, and reproduction. - Differentiate among cells, tissue, organs, and organs.
Primary Resources	The Biology Project: an online interactive resource for learning bioliogy The Cell Cycle & Mitosis Tutorial "Plant, Animal, and Bacteria Cell Models" CELLS alive
Essential Vocabulary	

Marking Period: 4th
Days: 20
Reporting Category/Strand:

SOL 12	The student will investigate and understand that organisms reproduce and transmit genetic information to new generations. Key concepts include a) the structure and role of DNA; b) the function of genes and chromosomes; c) genotypes and phenotypes; d) characteristics that can and cannot be inherited; e) genetic engineering and its applications; and f) historical contributions and significance of discoveries related to genetics.
Essential Knowledge/Skills/Understandings	• recognize the appearance of DNA as double helix in shape. • explain that DNA contains coded instructions that store and pass on genetic information from one generation to

	the next. • explain the necessity of DNA replication for the continuity of life. • explain the relationship among genes, chromosomes, and alleles. • demonstrate variation within a single genetic trait. • distinguish between dominant and recessive traits. • distinguish between genotype and phenotype. • use Punnett squares to predict the possible combinations of inherited factors resulting from single trait crosses. • differentiate between characteristics that can be inherited and those that cannot be inherited. • identify aspects of genetic engineering and supply examples of applications. Evaluate the examples for possible controversial aspects. • describe the contributions of Mendel, Franklin, Watson, and Crick to our basic understanding of genetics.
Essential Questions	- Use Punnett squares to predict the possible combinations of inherited traits. - Differentiate between characteristics that can be inherited and those that cannot be inherited.
Primary Resources	Learn .Genetics: Genetic Science Learning Center. The University of Utah. Cold Spring Harbor Laboratory "DNA from the beginning" Cold Spring Harbor Laboratory "Gene Almanac"
Essential Vocabulary	

Marking Period: 5th and 6th six weeks
Days: 29
Reporting Category/Strand:

SOL 4	The student will investigate and understand how organisms can be classified. Key concepts include a) the distinguishing characteristics of domains of organisms; b) the distinguishing characteristics of kingdoms of organisms; c) the distinguishing characteristics of major animal phyla and plant divisions; and d) the characteristics that define a species.

Essential Knowledge/Skills/Understandings	• classify organisms based on a comparison of key physical features and activities. • arrange organisms in a hierarchy according to similarities and differences in features. • categorize examples of organisms as representative of the three domains (Archaea, Bacteria and Eukarya) and recognize that the number of domains is subject to change as new data are collected. • categorize examples of organisms as representative of the kingdoms and recognize that the number of kingdoms is subject to change as new data are collected. • recognize examples of major animal phyla. • recognize examples of major plant divisions. • recognize scientific names as part of a binomial nomenclature.
Essential Questions	- Categorize examples of organisms as representatives of each of the Kingdoms. - Categorize examples of organisms as representatives of Arachaea, Bacteria and Eukarya.
Primary Resources	eNature.com. Bringing Nature to Life Animal Diversity Web
Essential Vocabulary	