Westside High School
2018 - 2019 Curriculum Map: Biology

Teacher: K.Smith **Revised: Sept 2018**

Map is still under construction and will be revised throughout the year.

WESTSIDE HIGH SCHOOL SCIENCE CURRICULUM MAP

Teacher:

Unit 1 **Topic: Structure, Function and Interactions within body systems** **DNA Structure and Genetic Variations**
Essential Questions: How do separate systems within the body work together to function as a whole unit? What is homeostasis and how does it impact the function of the body? What is the relationship between cellular division and the formation of hereditary characteristics? How does the structure of the DNA molecule work to form hereditary characteristics? What is the connection between the DNA structure and genetic variations?
Students will be able to. . . . Develop a hierarchy relationship between cells and overall body structure and function. Determine the use and function of homeostasis on body systems. Make connections between cellular division and the passing of traits and characteristics from parent to offspring. Determine the structure of a DNA molecule and how that structure is connected to the formation of chromosomes, genes, amino acids, proteins, and ultimately traits. State the impact of DNA mutations on hereditary characteristics often resulting in evolutionary changes. Analyze the probability of traits and characteristics changing over a specified period of time.
AR STANDARDS / SKILLS *CONTENT VOCABULARY WITHIN THE STANDARD WILL BE TAUGHT THROUGHOUT DAILY OBJECTIVES / GOALS.*
BI-LS1-1 **Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.** [Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.] **BI-LS1-2** **Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.** [AR Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. Examinations could include all types of multicellular organisms.

Examples of an interacting system could include an artery depending on the proper function of elastic tissue and a smooth muscle regulating and delivering proper amounts of blood within the circulatory system]. [Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.]

BI-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. [Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.] [Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.]

BI-LS1-6 Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. [Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations.] [Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of macromolecules.]

BI-LS1-4 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. [Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.]

BI-LS3-1 Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]

BI-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. [Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.] [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]

BI-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. [Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] [Assessment Boundary: Assessment does not include Hardy-Weinberg calculations.]

Science/Engineering Practices	Disciplinary Core Idea	Crosscutting Concepts:	
Science and Engineering Practices **Developing and Using Models** Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.	**Disciplinary Core Ideas** **LS1.B: Growth and Development of Organisms** ▪ In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that	**Systems and System Models** · Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. LS1-4)	

▪ Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (BI-LS1-2) **Planning and Carrying Out Investigations** Planning and carrying out in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. ▪ Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. LS1-3) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including	divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (BI-LS1-4) **LS1.A: Structure and Function** ▪ All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. -LS3-1, BI-LS1-1) **LS3.A: Inheritance of Traits** ▪ 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. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (BI-LS3-1) **LS3.B: Variation of Traits** ▪ In sexual reproduction, chromosomes can sometimes swap sections during the process	**Cause and Effect** ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. -LS3-1, BI-LS3-2) **Scale, Proportion, and Quantity** ▪ Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). LS3-3)	

students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. LS1-1) ▪ Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. -LS1-6) **---** **-----** ***onnections to Nature of Science*** **Scientific Investigations Use a Variety of Methods** ▪ Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings. (BI-LS1-3)	of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. LS3-2) ▪ Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. LS3-2, BI-LS3-3) ▪ Genetic information provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. (BI-LS4-1)		
Activities/Labs	**Assessments/Skills**	**Resources**	**Vocabulary**

http://www.cpalms.org/Public/PreviewResourceLesson/Preview/76250 (Macromolecule Lesson) Lost in the desert- homeostasis investigation. Osmosis and Diffusion lab.—Potato? Egg? Onion Skin lab Model DNA DNA fingerprint lab Isolate plant-based DNA (Strawberries) Disorder research project Synthetic blood testing (will fit anywhere but fits best here) Solving heredity problems activity Enzyme foldable	Lab analysis Lab safety Diagram of the cell (plant and animal) Diagram cellular division (mitosis AND Meiosis) DNA Graphic organizer Heredity activity write up	Text Lab Book Notes Videos/alternate materials	All lab tool names Carbohydrate Protein Lipid Nucleic Acid Homeostasis Osmosis Cell membranes Diffusion Cellular Hierarchy Mitosis Meiosis Mutations Base Pairs (names and rules) Gene Chromosome Codon Crossing-over Independent assortment Probability Prokaryote Eukaryote Nitrogen fixing bacteria

Unit 2
Topic: Evolution by Natural Selection
Essential Questions: What is the relationship between DNA, heritable characteristics, and evolution of a species through natural selection? What is simultaneous Co-evolution and what is the basis for this theory? How do the interactions between biotic and abiotic components affect the process of evolution? How does group behavior affect the ultimate survival or extinction of a species?

What is the geologic evidence available to support the theory of evolution of a species?

Students will be able to…..
Describe the theory of evolution by natural selection citing scientific evidence to support the theory.
Determine the effects of biotic and abiotic factors on survival of a species.
Use the geological record to determine causes for species extinction and the appearance of new traits and hereditary characteristics.
Determine how changes in the early atmosphere and physical environment allowed species to emerge or decline.

AR STANDARDS / SKILLS
CONTENT VOCABULARY WITHIN THE STANDARD WILL BE TAUGHT THROUGHOUT DAILY OBJECTIVES / GOALS

nts who demonstrate understanding can:

BI-LS4-1 **Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.** [Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.]

BI-LS4-2 **Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.** [Clarification Statement: Emphasis is on using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.] [Assessment Boundary: Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.]

BI-LS4-3 **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.** [Clarification Statement: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations.] [Assessment Boundary: Assessment is limited to basic statistical and graphical analysis. Assessment does not include allele frequency calculations.]

BI-LS4-4 **Construct an explanation based on evidence for how natural selection leads to adaptation of populations.** [Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations.]

BI-LS4-5 **Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.** [Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.]

BI-ESS2-7 **Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.** [AR Clarification Statement: This PE is fully addressed in this course. Emphasis in the course is on developing a claim and evaluating and critiquing the evidence for simultaneous co-evolution. Emphasis is on the causes, effects, and feedback loops between the biosphere and

Earth's other systems which continuously alters Earth's surface. Examples could include how photosynthetic life altered the atmosphere through the production of oxygen, which increased weathering rates and allowed for the evolution of animal life; how microbial life on land increased the formation of soil which allowed for the evolution of land plants; and how the evolution of corals created reefs which altered patterns of erosion and deposition along coastlines and provided habitats for the evolution of life forms.] [Assessment Boundary: Assessment does not include a comprehensive understanding of the mechanisms of how the biosphere interacts with all of Earth's other systems.]

BI-LS2-8 **Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.** [Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.]

Science and Engineering Practices	**Disciplinary Core Idea**	**Crosscutting Concepts:**	
Science and Engineering Practices **Analyzing and Interpreting Data** Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ▪ Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (BI-LS4-3) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are	**LS4.B: Natural Selection** ▪ Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. (BI-LS4-2, BI-LS4-3) ▪ The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (BI-LS4-3) **LS4.C: Adaptation** ▪ Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in	**Crosscutting Concepts** **Patterns** ▪ Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. -LS4-1, BI-LS4-3) **Cause and Effect** ▪ Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. LS4-2, BI-LS4-4, S4-5)	

supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. LS4-2, BI-LS4-4) **Engaging in Argument from Evidence** Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current or historical episodes in science. ▪ Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. LS4-5) ▪ Construct an oral and written argument or counter-arguments based on data and evidence. (BI-ESS2-7) **Obtaining, Evaluating, and Communicating Information** Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and	a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. LS4-2) ▪ Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. LS4-3, BI-LS4-4) ▪ Adaptation also means that the distribution of traits in a population can change when conditions change. LS4-3) ▪ Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the	**Stability and Change** ▪ Much of science deals with constructing explanations of how things change and how they remain stable. (BI-ESS2-7) **---------------------------------** ***onnections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** ▪ Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. LS4-1, BI-LS4-4)	

progresses to evaluating the validity and reliability of the claims, methods, and designs. ▪ Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (BI-LS4-1) -- ***Connections to Nature of Science*** **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** ▪ A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. LS4-1)	expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (BI-LS4-5) ▪ Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. (BI-LS4-5) **LS2.D: Social Interactions and Group Behavior** ▪ Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (BI-LS2-8) **LS4.D: Biodiversity and Humans** ▪ Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). (BI-LS2-7) ▪ **ESS2.D: Weather and Climate** ▪ Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. (BI-ESS2-7) **ESS2.E: Biogeology** The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual		

	co-evolution of Earth's surface and the life that exists on it. (BI-ESS2-7) ▪ The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. (BI-ESS2-4)		
Activities/Labs	**Assessments/Skills**	**Resources**	**Vocabulary/Terms**
Evolution Graphic organizer Antibiotic resistance lab Cladogram (maybe?) Natural Selection Scavenger Hunt Activity Making Coacervates Lab Alien Taxonomy activity Biology & History timetable	Coacervate Lab write up Natural Selection Activity write up Antibiotic resistance write up Unit tests Article review-group work Bell work	Board discussion notes on natural selection, extinction, ect Text Videos-Evolution in a Nutshell Alligator and nesting bird article	Natural Selection Artificial selection Evolution Fossil Record Extinction Speciation Adaptation Descent with modification Common descent Homologous structures Vestigial organs Polygenic traits Directional selection Stabilizing selection Disruptive selection Genetic drift Hardy-Weinberg principle Genetic equilibrium Reproductive isolation Geographical isolation

			Temporal isolation Mass extinction Taxonomy Binomial nomenclature Kingdom, phylum, class, order, family, genus, species. Phylogeny

Unit 3 **Topic: Cycling of Matter and Energy**
Essential Questions: How is matter and energy cycled through the body, other living organisms, and the various Earth spheres? In what way's do geological events affect how and when matter is cycled through the Earth? What is the relationship between photosynthesis, cellular respiration, and energy in the spheres? What is the chemical basis for water and how does that affect the properties of water? What is the connection between food webs and the flow of energy and matter?
Students will be able to….. State the process of photosynthesis and its connection to the flow of matter and energy in the biosphere. Determine how energy is transferred or conserved in the atmosphere and biosphere. Analyze and determine food webs to show the movement of energy. Make connections between photosynthesis, solar energy, and the "health" of specific areas.
AR STANDARDS / SKILLS *CONTENT VOCABULARY WITHIN THE STANDARD WILL BE TAUGHT THROUGHOUT DAILY OBJECTIVES / GOALS.*

nts who demonstrate understanding can:

BI-LS1-5 **Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.** [AR Clarification Statement: This PE is fully addressed in this course. Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [Assessment Boundary: Assessment does not include specific biochemical steps.]

BI-LS1-7 **Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.** [Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.] [Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in cellular respiration.]

BI-LS2-3 **Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.** [Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.]

BI-LS2-4 **Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.** [AR clarification Statement: This PE is fully addressed in this course. Emphasis is on the transfer of energy and matter between trophic levels and the relative proportion of organisms at each trophic level.] [Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.

BI-LS2-5 **Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.** [Clarification Statement: Examples of models could include simulations and mathematical models.] [Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.]

BI-ESS2-6 **Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.** [Clarification Statement: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.]

BI-ESS2-4 **Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.** [Clarification Statement: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.] [Assessment Boundary: Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.]

BI-ESS2-5 **Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.** [AR Clarification Statement: This PE is partially addressed in this course. Emphasis is on the properties of water and the water cycle.]

BI-ESS3-6 **Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity**. [AR Clarification Statement: Examples of Earth systems to be considered are the hydrosphere, atmosphere, cryosphere, geosphere, and biosphere. Examples of far-reaching impacts related to human activity, include how increases in one or more atmospheric gasses (COx, NOx, Sox), and volatile organic compounds), and particulate matter could impact other Earth systems. For example, an increase in carbon dioxide results in an increase in photosynthetic biomass and ocean acidification with resulting impacts on marine populations.] [Assessment Boundary: Assessment does not include running computational representations but is limited to using the published results of scientific computational models.]

Science/Engineering Practices	Disciplinary Core Idea	Crosscutting Concepts:	
Developing and Using Models Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds. ▪ Use a model based on evidence to illustrate the relationships between systems or between components of a system. (BI-LS1-5, B-LS1-7) ▪ Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (BI-ESS2-6, BI-LS2-5) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. ▪ Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as	**LS1.C: Organization for Matter and Energy Flow in Organisms** ▪ The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. LS1-5) ▪ As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (BI-LS1-7) ▪ As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment. (BI-LS1-7) **LS2.B: Cycles of Matter and Energy Transfer in Ecosystems** ▪ Photosynthesis and cellular respiration (including anaerobic processes) provide	**Energy and Matter** · Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (BI-LS1-5) · Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. LS1-7, BI-LS2-4) ▪ The total amount of energy and matter in closed systems is conserved. (BI-ESS2-6) ▪ Energy drives the cycling of matter within and between systems. LS2-3) **Systems and System Models** ▪ Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. LS2-5)	

they did in the past and will continue to do so in the future. (BI-LS1-6, BI-LS2-3) **Using Mathematics and Computational Thinking** Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. · Use mathematical representations of phenomena or design solutions to support claims. (BI-LS2-4)	most of the energy for life processes. (BI-LS2-3) ▪ Plants or algae 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. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. LS2-4) ▪ Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. (BI-LS2-5)		

Activities/Skills	Assessments	Resources	Vocabulary/Terms
	: Energy in Chemical Processes ▪ The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. (BI-LS2-5) **ESS2.D: Weather and Climate** ▪ Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. (BI-ESS2-6) ▪ Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (BI-ESS2-6) **ESS2.C: The Roles of Water in Earth's Surface Processes** ▪ The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. ▪ BI-ESS2-5		

• Effects of Light Intensity on Photosynthesis lab • Cellular respiration lab • Water cycle graphic •	• Cellular respiration write up • Photosynthesis write up • Bell work • Unit test • Water cycle graphic	• Text • Lab manual(s) • Notes • Videos/alternate resources	**Cellular respiration** **Photosynthesis** **Aerobic** **Anaerobic** **Energy** **Carbon cycle** **Evaporation** **Transpiration** **Biogeochemical cycles** **Nutrients** **Nitrogen fixation** **Denitrification** **Algal bloom** **Limiting nutrient** **Primary productivity** **Trophic levels** **Herbivore** **Carnivore** **Omnivore** **Detritivores** **Decomposers** **Chemosynthesis** **Heterotrophs** **Consumers** **Autotrophs** **Producers**

Unit 4

Topic: Life and Earth systems, Ecosystems and Population Dynamics

Essential Questions:
How have changes to Earths' surface caused changes to all other systems on Earth? Do these changes continue to take place today?
In what way has Earths normal cyclic changes affected global climate and populations on Earth?
What is the basis for carrying capacities?
What information can be determined about future climates from current global climate models and statistics?

Students will be able to…..
Determine the impact of sudden global changes on ecosystems and ultimately climate.
Determine carrying capacities for specific locations based on resources present.
Make connections between Earths' normal cyclic changes, orbit, tilt, EMS, and climate changes.
Analyze current global climate models to determine cause and effect relationships between populations and climate change.
Analyze the effects of CO_2 on climate.

AR STANDARDS / SKILLS

CONTENT VOCABULARY WITHIN THE STANDARD WILL BE TAUGHT THROUGHOUT DAILY OBJECTIVES / GOALS.

nts who demonstrate understanding can:

BI-LS2-1 **Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.** [Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] [Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.]

BI-LS2-2 **Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.** [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [Assessment Boundary: Assessment is limited to provided data.]

BI-LS2-6 **Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.** [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]

4-6 **Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on**

biodiversity.* [AR Clarification Statement: Emphasis is on refining solutions for a proposed problem related to threatened or endangered species, genetic variation of organisms for multiple species, and biodiversity.]

BI3-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. [AR Clarification Statement: Problems could include effect of logging on animal or human populations, response to invasive species, agricultural practices, creating dams, and maintaining fish populations in public lakes.]

BI3-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. [AR Clarification Statement: Examples could include simulations of population dynamics, genetic drift, evolution, and migration.]

BI-ESS3-5 Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems. [AR Clarification Statement: Examples of evidence (precipitation and temperature) for both data and climate models and the associated impacts (sea level changes, glacial ice volumes, and atmosphere and ocean composition) could be found at National Oceanic and Atmospheric Administration, National Weather Service, and United States Geological Survey.] [Assessment Boundary: Assessment is limited to one example of a climate change and its associated impacts.]

BI-ESS2-2 Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. [Clarification Statement: Examples could include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent.]

Science/Engineering Practices	Disciplinary Core Idea	Crosscutting Concepts:	
Science and Engineering Practices **Using Mathematics and Computational Thinking** Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and	**LS2.A: Interdependent Relationships in Ecosystems** · Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation,	**Cause and Effect** · Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. LS2-8, BI-LS4-6) **Scale, Proportion, and Quantity** · The significance of a phenomenon is dependent on the scale, proportion, and	

computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. · Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (BI-LS2-1) · Use mathematical representations of phenomena or design solutions to support and revise explanations. (BI-LS2-2) ▪ Create or revise a simulation of a phenomenon, designed device, process, or system. (BI-LS4-6) ▪ Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interactions between systems. (BI3-ETS1-4) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. · Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized	competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. LS2-1, BI-LS2-2) **: Ecosystem Dynamics, Functioning, and Resilience** · A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (BI-LS2-2, BI-LS2-6) · Moreover, anthropogenic changes (induced by human activity) in the environment—including	quantity at which it occurs. (BI-LS2-1) · Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (BI-LS2-2) **Stability and Change** · Much of science deals with constructing explanations of how things change and how they remain stable. LS2-6, BI-LS2-7) **Systems and System Models** · Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. 3-ETS1-4) --------------------------------------- ***Connections to Engineering, Technology, and Applications of Science*** **Influence of Science, Engineering, and Technology on Society and the Natural World** New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical	

criteria, and tradeoff considerations. (BI-LS2-7) · Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (BI3-ETS1-3) **Engaging in Argument from Evidence** Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. · Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. (BI-LS2-6) · Evaluate the evidence behind currently accepted explanations to determine the merits of arguments. (BI-LS2-8) -- ***onnections to Nature of Science*** **Scientific Knowledge is Open to Revision in Light of New Evidence** · Scientific argumentation is a mode of logical discourse used to clarify	habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (BI-LS2-7 **ESS1.B: Earth and the Solar System** Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes.(BI-ESS2-4) **ESS2.A: Earth Materials and Systems** · Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (BI-ESS2-2) · The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time	aspect of decisions about technology. (BI3-ETS1-3)	

the strength of relationships between ideas and evidence that may result in revision of an explanation. (BI-LS2-6, BI-LS2-8)	scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. (BI-ESS2-4) **ESS2.D: Weather and Climate** · The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. (BI-ESS2-2, BI-ESS2-4) · Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (BI-ESS2-4) **ESS2.D: Weather and Climate** ▪ Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. ESS3-6) **ESS3.B: Natural Hazards**		

	▪ Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. ESS3-1) .		
Activities/Skills	**Assessments**	**Resources**	**Vocabulary/Terms**
"Sharks and Minnows"-survival of the fittest Investigating chemical cycles lab Food web diagram "How many raccoons can live in the woods" activity	Various write ups for activities Food web diagram Unit test Bell work	Text Notes Videos/alternate resources American Alligator and Nesting Birds Article	**Food web** **Ecosystem dynamic** **Carrying capacity** **Distribution** **Displacement** **Community interactions** **Mutualism** **Commensalism** **Parasitism** **Symbiosis** **Predation** **Primary and Secondary ecological succession** **Biomes: Tropical Rain Forrest, Tropical Dry Forrest, Tropical Savanna, Desert, Temperate Grassland, Temperate Woodland, Temperate Forrest, Northwestern Coniferous Forest, Boreal Forest, Tundra.** **Permafrost** **Deciduous** **Coniferous** **Wetland** **Population density** **Exponential growth** **Immigration** **Emmigration** **Limiting factor** **Density-dependent/ density-independent**

Unit 5

Topic: Human activity and effects on the Environment

Essential Questions:
What are natural resources?
How is the use of natural resources contributing to environmental imbalances?
What is the effect of human activity on the increase of CO_2 in the environment?
How can using sustainability of natural resources prevent environmental deterioration?
What is the effect of cost on use of resources?

Students will be able to…..
Analyze the impact of human activity on environmental factors.
Determine the effects of human activity on the amount of CO_2 in the atmosphere.
Develop creative methods for reducing human impact on the environment.

AR STANDARDS / SKILLS

CONTENT VOCABULARY WITHIN THE STANDARD WILL BE TAUGHT THROUGHOUT DAILY OBJECTIVES / GOALS.

Students who demonstrate understanding can:

BI-ESS3-1 **Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.** [AR Clarification Statement: This PE is fully addressed in this course. Emphasis is on the way climate change has impacted human populations and how natural resources and natural hazards impact human societies. Examples of climate change results which affect populations or drive mass migrations could include changes to sea level, regional patterns of temperature and precipitation, and types of crops and livestock available. Examples of the dependence of human populations on technology to acquire natural resources and to avoid natural hazards could include damming rivers, natural gas fracking, thunderstorm sirens, and severe weather text alerts.]

BI-ESS3-2 **Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.*** [AR Clarification Statement: This PE is fully addressed in this course. Emphasis is on the designs of possible solutions. Emphasis is on the conservation, recycling, and reuse of resources (minerals and metals), and on minimizing impacts.

Examples could include developing best practices for agricultural soil use, mining (coal, tar sands, and oil shales), and pumping (petroleum and natural gas).]

BI-ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. [Clarification Statement: Examples of factors that affect the management of natural resources include costs of resource extraction and waste management, per-capita consumption, and the development of new technologies. Examples of factors that affect human sustainability include agricultural efficiency, levels of conservation, and urban planning.] [Assessment Boundary: Assessment for computational simulations is limited to using provided multi-parameter programs or constructing simplified spreadsheet calculations.]

BI-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.* [AR Clarification Statement: This PE is partially addressed in this course. Examples of data on the impacts of human activities could include the quantities and types of pollutants released, changes to biomass and species diversity, and changes in land surface (urban development, agriculture or livestock, and surface mining). Examples for limiting future impacts could range from local efforts (reducing, reusing, and recycling resources) to large-scale bioengineering design solutions (altering global temperatures by making large changes to the atmosphere or ocean).]

BI7-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. [AR Clarification Statement: Examples could include recycling, increased atmospheric carbon dioxide, ocean acidification, impacts on marine populations, increased wildfire occurrence, deforestation, and overfishing.]

'S1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. [AR Clarification Statement: Simulations could include management of natural resources for sustainable yields, agricultural efficiency to feed a growing world population, and urban planning to maximize green space.]

BI-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* [AR Clarification Statement: This PE is fully addressed in this course. Emphasis is on the impact of human activities on biodiversity such as dissemination of invasive species, habitat degradation, and water quality.] [AR Assessment Boundary: Assessment is to include student choice from multiple scenarios.]

BI3-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. [AR Clarification Statement: Problems could include effect of logging on animal or human populations, response to invasive species, agricultural practices, creating dams, and maintaining fish populations in public lakes.]

Science/Engineering Practices	Disciplinary Core Idea	Crosscutting Concepts:	
Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8	**ESS3.A: Natural Resources** · Resource availability has guided the development of human society.	**Cause and Effect** · Empirical evidence is required to differentiate between cause and correlation and make	

experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. ▪ Create a computational model or simulation of a phenomenon, designed device, process, or system. (BI-ESS3-3) ▪ Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (BI-ESS3-6) ▪ Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interactions between systems. /-ETS1-4) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific knowledge, principles, and theories. ▪ Construct an explanation based on valid and reliable evidence obtained from a variety of sources	ESS3-1) · All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. (BI-ESS3-2) **ESS3.C: Human Impacts on Earth Systems** · The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (B-ESS3-3) · Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (BI-ESS3-4) **ESS3.D: Global Climate Change** · Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. ESS3-6) **ETS1.A: Defining and Delimiting Engineering Problems** · Criteria and constraints also include satisfying any	claims about specific causes and effects. ESS3-1) **Systems and System Models** ▪ When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. ESS3-6) · Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. /-ETS1-4) **Stability and Change** ▪ Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (BI-ESS3-3) ▪ Feedback (negative or positive) can stabilize or destabilize a system. ESS3-4) ***-------------------------------------Connections to Engineering, Technology, and Applications of Science***	

(including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (BI-ESS3-1) ▪ Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (BI-ESS3-4) **Engaging in Argument from Evidence** Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ▪ Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). ESS3-2) **Asking Questions and Defining Problems** questions and defining problems in 9–12 builds on K–8 experiences and	requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (BI7-ETS1-1) · Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (BI7-ETS1-1) **ETS1.B: Developing Possible Solutions** · When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. ESS3-2, BI-ESS3-4) · Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is	**Influence of Engineering, Technology, and Science on Society and the Natural World** ▪ Modern civilization depends on major technological systems. ESS3-1, BI-ESS3-3) ▪ Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. (BI-ESS3-2, ESS3-4) ▪ New technologies can have deep impacts on society and the environment, including some that were not anticipated. (BI-ESS3-3) ▪ Analysis of costs and benefits is a critical aspect of decisions about technology. (BI-ESS3-2) ▪ New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. 7-ETS1-1) ----------------------------------- ***Connections to Nature of Science*** **Science is a Human Endeavor** ▪ Science is a result of human endeavors, imagination, and creativity. (BI-ESS3-3)	

progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations. · Analyze complex real-world problems by specifying criteria and constraints for successful solutions. (BI7-ETS1-1)	most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (BI7-ETS1-4) · Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (BI-LS4-6, BI-LS2-7) **ESS3.D: Global Climate Change** ▪ Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. (BI-ESS3-5) **ESS2.D: Weather and Climate** ▪ Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. (BI-ESS2-6)	**Science Addresses Questions About the Natural and Material World** ▪ Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. (BI-ESS3-2) ▪ Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. ESS3-2) ▪ Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. ESS3-2)	

	Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (BI-ESS2-6)		
Activities/Skills	**Assessments**	**Resources**	**Vocabulary/Terms**
Observing decomposition lab Effects of acid rain lab	Lab write up Unit assessments Bell work	Notes Text Alternate resources/videos	**Hunting/gathering** **Agriculture** **Green revolution** **Renewable/nonrenewable resources** **Soil erosion** **Desertification** **Sustainable development** **Deforestation** **Pollutant** **Acid rain** **Invasive species** **Conservation** **Ozone depletion** **Global warming**