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JC Schools Honors Biology Yearly Science Standards

	Overarching Standards
	9-12.ETS1.A.1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants **9-12.ETS1.A.2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering **9-12.ETS1.B.1** 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 **9-12.ETS1.B.2** 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
Units	**Priority Standards**
Unit 1 Ecosystem Interactions and Dynamics (Serengeti Storyline)	**9-12.LS2.A.1** **EXPLAIN** how various biotic and abiotic factors affect the carrying capacity and biodiversity of an ecosystem using mathematical and or computational representations [Clarification Statement: Examples of biotic factors could include relationships among individuals (e.g., feeding relationships, symbioses, competition) and disease. Examples of abiotic factors could include climate and weather conditions, natural disasters, and the availability of resources. Genetic diversity includes a population and species within an ecosystem. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] **9-12.LS2.B.2**

	COMMUNICATE the pattern of the cycling of matter and the flow of energy among trophic levels in an ecosystem.[Clarification Statement: Emphasis is on using a model of stored energy in biomass to describe the transfer of energy from one trophic level to another. Emphasis is on atoms and molecules as they move through an ecosystem.] **9-12.LS2.C.1** **EVALUATE** the claims, evidence, and reasoning that the interactions in ecosystems maintain relatively consistent populations of species while conditions remain stable, but changing conditions may result in new ecosystem dynamics.[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.] **9-12.LS2.C.2** **DESIGN, EVALUATE, and/or REFINE** solutions that positively impact the environment and biodiversity**.** [Clarification Statement: Examples of solutions may include captive breeding programs, habitat restoration, pollution mitigation, energy conservation, agriculture and mining programs, and ecotourism.] **9-12.LS4.C.3** **CREATE or REVISE** a model to test a solution to mitigate adverse impacts of human activity on biodiversity. [Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species or to genetic variation of organisms for multiple species.]
Unit 2 Ecosystem Interaction and Dynamics (Zombie Fire Storyline)	**9-12.LS1.C.1** **USE** a model to **DEMONSTRATE** how photosynthesis transforms light energy into stored chemical energy **9-12.LS1.C.2** **USE** a model **to DEMONSTRATE** that cellular respiration is a chemical process whereby the bonds of molecules are broken, and the bonds in new compounds are formed, resulting in a net transfer of energy **9-12.LS1.C.3** **CONSTRUCT and REVISE** an explanation based on evidence that organic macromolecules are primarily composed of six elements, where carbon, hydrogen, and oxygen atoms may combine with nitrogen, sulfur, and phosphorus to form large carbon-based molecules **9-12.LS2.B.1** **CONSTRUCT and REVISE** an explanation based on evidence that the process of photosynthesis, chemosynthesis, and aerobic and anaerobic respiration are responsible for the cycling of matter and flow of energy through ecosystems and that environmental conditions restrict which reactions can occur **9-12.LS2.B.2**

	COMMUNICATE the pattern of the cycling of matter and the flow of energy among trophic levels in an ecosystem. **9-12.LS2.B.3** **USE** a model **that ILLUSTRATES** the roles of photosynthesis, cellular respiration, decomposition, and combustion to explain the cycling of carbon in its various forms among the biosphere, atmosphere, and geosphere **9-12.LS2.C.1** **EVALUATE** the claims, evidence, and reasoning that the interactions in ecosystems maintain relatively consistent populations of species while conditions remain stable, but changing conditions may result in new ecosystem dynamics.[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.] **9-12.LS2.C.2** **DESIGN, EVALUATE, and/or REFINE** solutions that positively impact the environment and biodiversity**. [**Clarification Statement: Examples of solutions may include captive breeding programs, habitat restoration, pollution mitigation, energy conservation, agriculture and mining programs, and ecotourism.] **9-12.LS4.C.3** **CREATE or REVISE** a model to test a solution to mitigate adverse impacts of human activity on biodiversity. [Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species or to genetic variation of organisms for multiple species.] **9-12.ESS2.D.1** **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. **9-12.ETS1.A.2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering
Unit 3 Inheritance and Variation of Traits	**9-12.LS1.A.1** **CONSTRUCT** a model of how the structure of DNA determines the structure of proteins that carry out the essential functions of life through systems of specialized cells. [Clarification Statement: Genes are the regions in DNA that code for proteins. Basic transcription and translation explain the roles of DNA and RNA in coding the instructions for making polypeptides.] **9-12.LS1.A.2**

	DEVELOP and **USE** a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. [Clarification Statement: Emphasis on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to stimuli.] **9-12.LS1.B.1** **DEVELOP** and **USE** models to communicate the role of mitosis, cellular division, and differentiation in producing and maintaining complex organisms. [Clarification Statement: Major events of the cell cycle include cell growth, DNA replication, preparation for division, separation of chromosomes, and separation of cell contents.] **9-12.LS3.A.1** **DEVELOP** and **USE** models to clarify relationships about how DNA in the form of chromosomes is passed from parents to offspring through the processes of meiosis and fertilization in sexual reproduction. **9-12.LS3.B.1** **COMPARE** and **CONTRAST** asexual and sexual reproduction with regard to genetic information and variation in offspring. **9-12.LS3.B.2** **DEVELOP** and **USE** a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] **9-12.LS3.B.3** **MAKE** and **DEFEND** a claim that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) mutations 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.] **9-12.LS3.B.4** **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 (Punnett Squares) to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] **9-12.ETS1.A.1** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants

	9-12.ETS1.A.2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering **9-12.ETS1.B.1** 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
Unit 4 Natural Selection and Evolution of Populations	**9-12.LS4.A.2** **ANALYZE** displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. *[Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures]* **9-12.LS4.B.1** **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 the 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]* **9-12.LS4.B.2** **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 the numerical distribution of traits and using these shifts as evidence to support explanations]* **9-12.LS4.C.1** **CONSTRUCT** an explanation based on evidence for how natural selection leads to the 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]*

	9-12.LS4.C.2 **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, and application of fertilizers, droughts, floods, and the rate of change of the environment affect the distribution or disappearance of traits in species]* **9-12.LS4.C.3** **CREATE or REVISE** a model to test a solution to mitigate adverse impacts of human activity on biodiversity. *[Clarification* *Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]* **9-12.ETS1.A.1** Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants **9-12.ETS1.A.2** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering **9-12.ETS1.B.1** 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
Unit 5 Common Ancestry and Speciation	**9-12.LS3.A.1** **DEVELOP** and **USE** models to clarify relationships about how DNA in the form of chromosomes is passed from parents to offspring through the processes of meiosis and fertilization in sexual reproduction. **9-12.LS4.A.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. Communicate could mean written report, oral discussion, etc.] **9-12.LS4A.2** **ANALYZE** displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. *[Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures]* **9-12.LS4.B.1** **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 the 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]* **9-12.LS4.B.2** **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 the numerical distribution of traits and using these shifts as evidence to support explanations]* **9-12.LS4.C.1** **CONSTRUCT** an explanation based on evidence for how natural selection leads to the 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]* **9-12.LS4.C.2** **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, and application of fertilizers, droughts, floods, and the rate of change of the environment affect the distribution or disappearance of traits in species}*

	9-12.ETS1.A.2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering **9-12.ESS3.C.1** Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.