Missouri Science

Life Sciences: Grades 9-12

Life Sciences

1 **From Molecules to Organisms: Structure and Processes** LS1

A Structure and Function LS1.A

1 Construct a model of how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. 9-12.LS1.A-1

2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. 9-12.LS1.A-2

3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. 9-12.LS1.A-3

B Growth and Development of Organisms LS1.B

1 Develop and use models to communicate the role of mitosis, cellular division, and differentiation in producing and maintaining complex organisms. 9-12.LS1.B-1

C Organization for Matter and Energy Flow in Organisms LS1.C

1 Use a model to demonstrate how photosynthesis transforms light energy into stored chemical energy. 9-12.LS1.C-1

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-2

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.LS1.C-3

2 Ecosystems: Interactions, Energy, and Dynamics LS2

A Interdependent Relationships in Ecosystems 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. 9-12.LS2.A-1

B Cycles of matter and Energy Transfer in Ecosystems LS2.B

1. Construct and revise an explanation based on evidence that the processes 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-1
2. Communicate the pattern of the cycling of matter and the flow of energy among trophic levels in an ecosystem. 9-12.LS2.B-2
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, hydrosphere, and geosphere. 9-12.LS2.B-3

C Ecosystems Dynamics, Functioning and Resilience LS2.C 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. 9-12.LS2.C-1
2. Design, evaluate, and/or refine solutions that positively impact the environment and biodiversity. 9-12.LS2.C-2

3 Heredity: Inheritance and Variation of Traits LS3

A Inheritance of Traits LS3.A

1. Develop and use models to clarify relationships 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.A-1

B Variation of Traits LS3.B

1. Compare and contrast asexual and sexual reproduction with regard to genetic information and variation in offspring. 9-12.LS3.B-1
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. 9-12.LS3.B-2
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. 9-12.LS3.B-3
4. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. 9-12.LS3.B-4

4 Biological Evolution; Unity and Diversity LS4

A Evidence of Common Ancestry and Diversity LS4.A

1. Communicate scientific information that common and biological evolution are supported by multiple lines of empirical evidence. 9-12.LS4.A-1
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. 9-12.LS4.A-2

B Natural Selection 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. 9-12.LS4.B-1
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. 9-12.LS4.B-2

C Adaptation LS4.C

1. Construct an explanation based on evidence for how natural selection leads to adaptation of populations. 9-12.LS4.C-1
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. 9-12.LS4.C-2
3. Create or revise a model to test a solution to mitigate adverse impacts of human activity on biodiversity. 9-12.LS4.C-3