Biology

The Biology content provides more in-depth studies of the living world and enables students to make sense of emerging research findings and apply those understandings to solving problems. Students focus on five life science topics: Structure and Function, Inheritance and Variation of Traits, Matter and Energy in Organisms and Ecosystems, Interdependent Relationships in Ecosystems, and Natural Selection and Evolution. Engineering, Technology, and the Application of Science are integrated throughout instruction as students define problems and design solutions related to the course topics. There is a focus on multiple indicators including developing and using models, planning and conducting investigations, analyzing and interpreting data, using mathematical and computational thinking, constructing explanations and designing solutions. Students will engage in active inquiries, investigations, and hands-on activities at least 50% of the instructional time as they develop and demonstrate conceptual understandings along with research and laboratory skills described in the standards and indicators for science. Safety instruction is integrated into all activities, and students will implement safe procedures and practices when manipulating equipment, materials, organisms, and models. Standards followed by an asterisk (*) denote the integration of traditional science content with an engineering practice.

Biology/Life Science	
Topic	**Structure and Function**
S.B.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.
S.B.2	Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
S.B.3	Identify and describe the characteristics of living organisms based on taxonomic classification systems.
S.B.4	Develop and use a model to provide evidence that feedback mechanisms maintain homeostasis.
Topic	**Matter and Energy in Organisms and Ecosystems**
S.B.5	Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
S.B.6	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.
S.B.7	Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic respiration in different environments.
S.B.8	Use mathematical representations to support claims for the cycling of matter and flow of energy between trophic levels in an ecosystem. • transfer of calories • energy loss (entropy) • 10% Rule • bioaccumulation.
S.B.9	Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

Topic	Interdependent Relationships in Ecosystems
S.B.10	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
S.B.11	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
S.B.12	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 possibly leading to speciation.
S.B.13	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. *
S.B.14	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. *
Topic	**Inheritance and Variation of Traits**
S.B.15	Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
S.B.16	Develop and use a model to demonstrate the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
S.B.17	Make and defend a claim based on evidence that inheritable genetic variations may result from: • new genetic combinations through meiosis • viable errors occurring during replication • mutations caused by environmental factors.
S.B.18	Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.
Topic	**Natural Selection and Evolution**
S.B.19	Engage in argumentation utilizing evidence to support common ancestry and biological evolution. • phylogenetic trees • cladograms.
S.B.20	Construct an explanation based on evidence that the process of evolution primarily results from four factors: • potential for a species to increase in number • heritable genetic variation of individuals in a species due to mutation and sexual reproduction • competition for limited resources • the proliferation of those organisms that are better able to survive and reproduce in the environment.
S.B.21	Construct an explanation based on evidence for how natural selection leads to adaptation of populations.
S.B.22	Evaluate the evidence supporting claims that changes in environmental conditions drive natural selection.

Engineering, Technology, and Applications of Science	
Topic	**Engineering Design**
S.B.23	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
S.B.24	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
S.B.25	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.
S.B.26	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.