Biology

Standard 1: Cellular Structure and Function

B.1.1 Construct an explanation based on evidence for how chemical elements (i.e. carbon, hydrogen, oxygen, nitrogen, phosphorus and sulfur) can combine to form essential biological macromolecules (carbohydrates, lipids, proteins and nucleic acids) whose shapes determine their roles in different types of cellular processes (e.g., metabolism, homeostasis, growth and development, and heredity).
B.1.2 Develop and use models that illustrate how a cell membrane regulates the uptake of materials essential for growth and survival while removing or preventing harmful materials from accumulating through the processes of active and passive transport.
B.1.3 Develop and use models to illustrate how specialized structures within cells (nuclei, ribosomes, Golgi, endoplasmic reticulum) interact to produce, modify and transport proteins.
B.1.4 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Standard 2: Matter Cycles and Energy Transfer

B.2.1 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
B.2.2 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.
B.2.3 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

Standard 3: Interdependence

B.3.1 Use mathematical and/or computational representation to explain why the carrying capacity ecosystems can support is limited by the available energy, water, oxygen and minerals and by the ability of ecosystems to recycle the remains of dead organisms.
B.3.2. Design, evaluate, and refine a model which shows how human activities and natural phenomena can change the flow of matter and energy in an ecosystem and how those changes impact the environment and biodiversity of populations in ecosystems of different scales, as well as how these human impacts can be reduced.
B.3.3 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, and identify the impact of changing conditions or introducing non-native species into that ecosystem.

Standard 4: Inheritance and Variation in Traits

B.4.1 Develop and revise a model that clarifies the relationship between DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.
B.4.2 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.
B.4.3 Construct a model to explain that the unique shape and function of each protein is determined by the sequence of its amino acids, and thus is determined by the sequence of the DNA that codes for this protein.
B.4.4 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.
B.4.5 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.
B.4.6 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population

Standard 5: Evolution

B.5.1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence including both anatomical and molecular evidence.
B.5.2 Apply concepts of statistics and probability to support a claim that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. Evaluate evidence to explain the role of natural selection as an evolutionary mechanism that leads to the adaptation of species, and to support 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/or (3) the extinction of other species.
B.5.3 Analyze and interpret data for patterns in the fossil record and molecular data that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.