South Carolina College- and Career-Ready Science

Grades 9, 10, 11, 12

Adopted 2021

Biology

From Molecules to Organisms: Structures and Processes

B-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. B-LS1-1

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

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

B-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. B-LS1-4

B-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. B-LS1-5

B-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 other large carbon-based molecules necessary foressential life processes. B-LS1-6

B-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy. B-LS1-7

Ecosystems: Interactions, Energy, and Dynamics

B-LS2-1. Use mathematical and/or computational representations to support explanations of biotic and abiotic factors that affect carrying capacity of ecosystems at different scales. B-LS2-1

B-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. B-LS2-2

B-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. B-LS2-3

B-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. B-LS2-4

B-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. B-LS2-5

B-LS2-6. Evaluate 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. B-LS2-6

B-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on biodiversity and ecosystem health. B-LS2-7

B-LS2-8. Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce. B-LS2-8

Heredity: Inheritance and Variation of Traits

B-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. B-LS3-1

B-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. B-LS3-2

B-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. B-LS3-3

Biological Evolution: Unity and Diversity

B-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. B-LS4-1

B-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. B-LS4-2

B-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. B-LS4-3

B-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations. B-LS4-4

B-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. B-LS4-5

B-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. B-LS4-6

Chemistry

Matter and Its Interactions

C-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. C-PS1-1

C-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. C-PS1-2

C-PS1-3. Plan and conduct an investigation to gather evidence to compare the structure of substances at a bulk scale to infer the strength of various forces between particles. C-PS1-3

C-PS1-4. Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. C-PS1-4

C-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. C-PS1-5

C-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. C-PS1-6

C-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. C-PS1-7

C-PS1-8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay. C-PS1-8

Motion and Stability: Forces and Interactions

C-PS2-6. Communicate scientific and technical information about why the molecular structure determines the functioning of designed materials. C-PS2-6

Energy

C-PS3-4. Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperatures are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). C-PS3-4

Waves and Their Applications in Technologies for Information Transfer

C-PS4-4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. C-PS4-4

C-PS4-5. Communicate technical information about how some technological devices use the principles of the electromagnetic spectrum to cause matter to transmit and capture information and energy. C-PS4-5

Physics

Motion and Stability: Forces and Interactions

P-PS2-1. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. P-PS2-1

P-PS2-2. Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. P-PS2-2

P-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the effect of a force on a macroscopic object during a collision. P-PS2-3

P-PS2-4. Use mathematical representations of Newton's law of gravitation and Coulomb's law to describe and predict the gravitational and electrostatic forces between objects. P-PS2-4

P-PS2-5. Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current. P-PS2-5

P-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. P-PS2-6

Energy

P-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the following are known: 1) the change in energy of the other component(s) and 2) the energy flowing in and out of the system. P-PS3-1

P-PS3-2. Develop and use models to illustrate that energy can be explained by the combination of motion and position of objects at the macroscopic scale and the motion and position of particles at the microscopic scale. P-PS3-2

P-PS3-3. Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. P-PS3-3

P-PS3-5. Develop and use a model to illustrate the forces between two objects and the changes in energy of the objects due to their interaction through electric or magnetic fields. P-PS3-5

Waves and Their Applications in Technologies for Information Transfer

P-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. P-PS4-1

P-PS4-2. Design, evaluate, and refine a solution for improving how digital devices store and transmit information. P-PS4-2

P-PS4-3. Evaluate the claims, evidence, and reasoning about how electromagnetic radiation can be described either by a wave model or a particle model, and in some situations one model is more useful than the other. P-PS4-3

P-PS4-4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. P-PS4-4

P-PS4-5. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. P-PS4-5

Earth and Space Science

Earth's Place in the Universe

E-ESS1-1. Develop a model based on evidence to illustrate that energy generated by nuclear fusion within the sun (and other stars) radiates to and influences orbiting planets. E-ESS1-1

E-ESS1-2. Construct an explanation of the Big Bang Theory based on evidence to show that the universe is changing over time. E-ESS1-2

E-ESS1-3. Construct an explanation using evidence to explain the ways elements are produced over the life cycle of a star. E-ESS1-3

E-ESS1-4. Use mathematical or computational representations to predict the motion of orbiting objects in the universe due to gravity. E-ESS1-4

E-ESS1-5. Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. E-ESS1-5

E-ESS1-6. Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history. E-ESS1-6

Earth's Systems

E-ESS2-1. Use evidence to argue how Earth's internal and external processes operate to form and modify continental and ocean-floor features throughout Earth's history. E-ESS2-1

E-ESS2-2. Analyze data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. E-ESS2-2

E-ESS2-3. Develop a model based on evidence of Earth's interior that describes cycling of matter through convection processes. E-ESS2-3

E-ESS2-4. Use a model to describe how causes of short and long-term variations in the flow of energy into and out of Earth's systems result in changes to climate. E-ESS2-4

E-ESS2-5. Investigate the ways that water (given its unique physical and chemical properties) impacts various Earth systems. E-ESS2-5

E-ESS2-6. Develop a quantitative model to describe the cycling of carbon through the hydrosphere, atmosphere, geosphere, and biosphere. E-ESS2-6

E-ESS2-7. Communicate scientific information that illustrates how Earth's systems and life on Earth change and influence each other over time. E-ESS2-7

Earth and Human Activity

E-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources and occurrence of natural hazards have influenced human activity. E-ESS3-1

E-ESS3-2. Evaluate competing design solutions that address the impacts of developing, managing, and using Earth's energy and mineral resources. E-ESS3-2

E-ESS3-3. Use computational representation to illustrate the relationships among the management of Earth's resources, the sustainability of human populations, and biodiversity. E-ESS3-3

E-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. E-ESS3-4

E-ESS3-5. Analyze data and the results from global climate models to make an evidence-based forecast of the current rate of regional or global climate change and associated future impacts to Earth's systems. E-ESS3-5

E-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. E-ESS3-6

E-ESS3-7. Create an argument, based on evidence that describes how changes in climate on Earth have affected human activity. E-ESS3-7