Unit 1: Matter and Energy Transformations in Ecosystem **Instructional days**: **20**

In this unit of study, students *construct explanations* for the role of energy in the cycling of matter in organisms and ecosystems. They *apply mathematical concepts* to *develop evidence to support explanations* of the interactions of photosynthesis and cellular respiration, and they will *develop models to communicate these explanations*. Students also understand organisms' interactions with each other and their physical environment and how organisms obtain resources. Students utilize the crosscutting concepts of *matter and energy* and *systems, and system models* to make sense of ecosystem dynamics. Students are expected to use students *construct explanations* for the role of energy in the cycling of matter in organisms and ecosystems. They *apply mathematical concepts* to *develop evidence to support explanations* as they demonstrate their understanding of the disciplinary core ideas.

This unit is based on HS-LS1-5, HS-LS2-3, HS-LS2-4, and HS-LS2-5.

Unit 2: Interdependent Relationships in Ecosystems **Instructional days: 20**

In this unit of study, students formulate answers to the question *"how and why do organisms interact with each other (biotic factors) and their environment (abiotic factors), and what affects these interactions?*" Secondary ideas include the interdependent relationships in ecosystems; dynamics of ecosystems; and functioning, resilience, and social interactions, including group behavior. Students use *mathematical reasoning* and *models* to make sense of carrying capacity, factors affecting biodiversity and populations, the cycling of matter and flow of energy through systems. The crosscutting concepts of *scale, proportion, and quantity* and *stability and change* are called out as organizing concepts for the disciplinary core ideas. Students are expected to use *mathematical reasoning* and *models* to demonstrate proficiency with the disciplinary core ideas.

This unit is based on HS-LS2-1, HS-LS2-2, and HS-LS2-6.

Unit 3: Human Activity and Climate[1] **Instructional days: 20**

In this unit of study, students examine factors that have influenced the distribution and development of human society; these factors include climate, natural resource availability, and natural disasters. Students use *computational representations* to analyze how earth systems and their relationships are being modified by human activity. Students also develop an understanding of how human activities affect natural resources and of the interdependence between humans and Earth's systems, which affect the availability of natural resources. Students will apply their engineering capabilities to reduce human impacts on earth systems and improve social and environmental cost–benefit ratios. The crosscutting concepts of *cause and effect*, *systems and systems models*, *stability and change*, and *the influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for the disciplinary core ideas. Students will analyze and interpret data, use mathematical and computational thinking, and construct explanations as they demonstrate understanding of the disciplinary core ideas.

This unit is based on HS-ESS3-1, HS-ESS3-6, HS-ESS3-5, HS-ESS3-4, and HS-ETS1-3.

Unit 4: Human Activity and Biodiversity[2] **Instructional days: 20**

In this unit of study, *mathematical models* provide support for students' conceptual understanding of systems and students' ability to *design, evaluate, and refine solutions* for reducing the impact of human activities on the environment and maintaining biodiversity. Students create or revise a simulation to test solutions for mitigating adverse impacts of human activity on biodiversity. Crosscutting concepts of *systems and system models* play a central role in students' understanding of science and engineering practices and core ideas of ecosystems. Mathematical models also provide support for students' conceptual understanding of systems and their ability to develop design solutions for reducing the impact of human activities on the environment and maintaining biodiversity.

This unit is based on HS-ESS3-3, HS-LS2-7, HS-LS4-6, HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, and HS-ETS1-4

[1] and [2] This unit may be taught in Biology or the Capstone Course.

Unit 5: Cell Specialization and Homeostasis **Instructional days: 20**

Students formulate an answer to the question "*How do the structures of organisms enable life's functions?*" *S*tudents investigate explanations for the structure and functions of cells as the basic unit of life, of hierarchical organization of interacting organ systems, and of the role of specialized cells for maintenance and growth. The crosscutting concepts of *structure and function*, *matter and energy*, and *systems and system models* are called out as organizing concepts for the disciplinary core ideas. Students use *critical reading*, *modeling*, and *conducting investigations*. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas.

This unit is based on HS-LS1-1, HS-LS1-2, HS-LS1-3, and HS-LS1-4.

Unit 6: DNA and Inheritance **Instructional days: 20**

Students analyze data develop models to make sense of the relationship between DNA and chromosomes in the process of cellular division, which passes traits from one generation to the next. Students determine why individuals of the same species vary in how they look, function, and behave. Students develop *conceptual models* of the role of DNA in the unity of life on Earth and *use statistical models* to explain the importance of variation within populations for the survival and evolution of species. Ethical issues related to genetic modification of organisms and the nature of science are described. Students explain the mechanisms of genetic inheritance and describe the environmental and genetic causes of gene mutation and the alteration of gene expressions. The crosscutting concepts of *structure and function*, *patterns*, and *cause and effect* are used as organizing concepts for the disciplinary core ideas. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas.

This unit is based on HS-LS1-4, HS-LS3-1, and HS-LS3-2.

Unit 7: Natural Selection **Instructional days:20**

Students *constructing explanations* and *designing solutions*, *analyzing and interpreting data*, and *engaging in argument from evidence investigate* to make sense of the relationship between the environment and natural selection. Students also develop an understanding of the factors causing natural selection of species over time. They also demonstrate and understandings of how multiple lines of evidence contribute to the strength of scientific theories of natural selection. The crosscutting concepts of *patterns* and *cause and effect* serve as a organizing concepts for the disciplinary core ideas. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas.

This unit is based on Disciplinary Core Idea LS4.C (Adaptation), HS-LS4-4, HS-LS4-3, HS-LS4-5, and HS-LS2-8.

Unit 8: Evolution **Instructional days: 20**

Students construct explanations for the processes of natural selection and evolution and then communicate how multiple lines of evidence support these explanations. Students evaluate evidence of the conditions that may result in new species and understand the role of genetic variation in natural selection. Additionally, students can apply concepts of probability to explain trends in population as those trends relate to advantageous heritable traits in a specific environment. Students demonstrate an understanding of these concepts by obtaining, evaluating, and communicating information and constructing explanations and designing solutions. The crosscutting concepts of patterns and cause and effect support the development of a deeper understanding.

This unit is based on HS-LS4-1 and HS-LS4-2.

Note: *The number of instructional days is an estimate based on the information available at this time. 1 day equals approximately 42 minutes of seat time. Teachers are strongly encouraged to review the entire unit of study carefully and collaboratively to determine whether adjustments to this estimate need to be made.*