

Biology (4110) Course Overview Curriculum Document

Course Description

This comprehensive biology course relies heavily upon inquiry-based laboratory investigations and discussions to help students develop critical thinking skills. The course emphasizes cellular processes, structural biology, genetics, evolution, earth processes, and humans' impact upon the biosphere.

Credits

1

Prerequisites

none

Board Approved

May 1997

Revised

July 1998, May 2005, August 2017, May 2020, June 2022

Required Assessments

District-wide, standards-based common summative assessments

Textbooks/Resources

Miller, K. R., and Levine, J. S. (2023). *Biology*. Savvas Learning Company. [Updated Edition from 2019]
ISBN: 978-0-328-92512-4

Course Essential Understandings

As a result of successfully completing this course, students will understand that:

- All living things share characteristics that separate them from non-living things.
- Living things and their environment are interconnected.
- Living things are made of cells. Cells are matter and thus composed of atoms. In order for survival, cells need to rearrange atoms to complete life processes.
- Cells interact with their environment in order to maintain homeostasis.
- The sun is the main source of energy on Earth. Producers transform energy into usable chemical energy which then supports all other life forms on Earth.
- DNA is the molecule of inheritance and contains the code for making proteins.
- Genes are passed from parent to offspring and determine the traits of an organism. Trait diversity is a result of sexual reproduction and mutation.
- Through natural biogeochemical cycles and other mechanisms, the DNA of species will change over time.

Course Relevance Questions

- Why is there so much diversity with life on Earth?
- Why is there so much underlying similarity among all life forms on Earth?

Unit Overviews

Unit Name	Unit Description	Unit Relevance Question	Instructional Standards	Assessed Standards
Unit #1 - Characteristics of Life	The unit sets up the basic concepts of biology by using scientific processes. Students build understandings for what defines living things, the concepts of form and function, hierarchical organization of systems, and how these interact to maintain homeostasis in organisms.	<ol style="list-style-type: none"> 1. How do you know something is alive? 2. How does the way something is structured impact the way it works? 3. How do scientists use reasoning to defend a claim using collected evidence? 	HS-LS1-2 SEP-3	SEP-7
Unit #2 - Ecology	The study of the connections between organisms, and connections between organisms and their environment. The distribution and abundance of organisms on Earth is shaped by both biotic and abiotic factors. Ecology is studied at many levels, including organism, population, community, ecosystem, and biosphere.	<ol style="list-style-type: none"> 1. How are all living things and their environment interconnected? 2. How is the Earth a living system? 3. How do human actions impact the diversity and stability of ecosystems? 4. How can data be interpreted? 	HS-ESS2-4 HS-ESS2-6 HS-ETS1-1 HS-ETS1-3	HS-LS2-4 HS-LS2-6
Unit #3 - Biochemistry	Life is composed of a unique set of organic molecules, with carbon as the primary element. Life is a process that involves chemical reactions.	<ol style="list-style-type: none"> 1. How do organisms use chemistry to survive? 2. What materials are organisms made of? 	HS-LS1-6	HS-LS1-6
Unit #4 - Cell Processes	Cells are the basic structure of all life processes, understanding the functions of cells is the foundation for explaining the functions and interdependence of the hierarchy of structures in multicellular organisms. This unit focuses on the role of feedback mechanisms in maintaining homeostasis, such as osmosis.	<ol style="list-style-type: none"> 1. How do substances get into and out of cells? 2. How does the environment affect the movement of substances/molecules? 	HS-LS1-2 HS-LS1-3	HS-LS1-2 HS-LS1-3
Unit #5 - Energy Transfers, Photosynthesis, Cell Respiration	The transformation of the sun's energy to stored chemical energy is required for almost all life on Earth. This stored energy is then released and utilized through the process of cell respiration.	<ol style="list-style-type: none"> 1. How is energy transferred in Earth systems? 2. How is energy required by living systems? 	HS-ESS1-1 HS-LS2-3 HS-LS1-5 HS-LS1-7	HS-LS1-5 HS-LS1-7
Unit #6 - DNA Structure and Protein Synthesis	DNA is the molecule of inheritance and the language which is translated into the language of proteins. Gene expression is a regulated process that results in differentiated and specialized cells, and expressed differently in prokaryotic and eukaryotic cells.	<ol style="list-style-type: none"> 1. How does genetic material transform into proteins 2. How does UV light harm our cells to the point of cell death and causing cancer? 3. What controls gene expression? 4. How does the information in DNA get transferred into observable traits? 	HS-ETS1-1 HS-ETS1-2 HS-LS1-1 HS-LS3-1 HS-LS3-2	HS-LS1-1 HS-LS3-2

Unit #7 - Genetic Inheritance	Establishes the mechanisms of inheritance. Identifies the role of DNA as the unit of inheritance and lays out the basics of Mendelian genetics. Trait diversity is a result of sexual reproduction and mutation.	<ol style="list-style-type: none"> 1. How are characteristics of one generation passed to the next? 2. Why do individuals of the same species vary in how they look, function, and behave? 	HS-LS3-1 HS-LS3-2 HS-LS3-3	HS-LS3-2 HS-LS3-3
Unit #8 - Evolution	Using multiple lines of empirical evidence, students will explain the process of evolution. Through natural biogeochemical cycles and other mechanisms, the DNA of species will change over time. Species will increase in number, have heritable variation, and compete for resources that allow organisms to better survive and reproduce. Changes in environmental conditions will cause changes in populations. Concepts of statistics and probability will be used to explain these phenomena.	<ol style="list-style-type: none"> 1. How do we know living things have changed over time? 2. How does natural selection lead to changes in species over time? 3. How can environmental changes impact traits in a population? 	HS-ESS1-5 HS-ESS2-7 HS-LS2-8 HS-LS4-1 HS-LS4-2 HS-LS4-4	HS-LS4-1 HS-LS4-2 HS-LS4-4