

NORTH CAROLINA STANDARD COURSE OF STUDY K-12 Science, Biology

The North Carolina 2023 K-12 Science Standards are intended to foster conceptual understanding and help develop scientifically literate students. The standards provide foundational knowledge and practices within each grade band and course. The standards are organized within 11 strands which articulate vertical alignment. As students progress from one grade to the next, the depth of knowledge and level of sophistication increases.

Engaging in science encourages students' curiosity, interests, and prepares them for the broadest range of postsecondary opportunities, be it college, career, or military service. The 2023 K-12 Science Standards are designed to allow students to become active participants in science - building their understanding of the natural world through observations and investigations.

The scientific method provides a common framework for introducing the traditional experimental design and hypothesis-testing process. The methodologies or approaches utilized by scientists can vary depending on the nature of their research questions and available tools. Steps that all scientists follow when conducting scientific investigations usually involve asking questions, the collection and analysis of relevant data, the use of logical reasoning, opportunities to communicate and collaborate with others, and the development of explanations.

The Science and Engineering Practices (SEP) are embedded in the standards to support a greater emphasis on how students develop science knowledge and the durable skills within the NC Portrait of a Graduate. While one practice is identified in each objective, teachers should utilize other practices to support students' progress towards mastering the standards.

The North Carolina Science Standards maintain the respect for local control of each Public School Unit (PSU). These standards and objectives are not intended to be the curriculum, nor do they indicate the whole of a curriculum which will be written by a PSU or school. The K-12 Science Standard Course of Study has been developed to serve as the framework for a well-planned science curriculum which provides opportunities for investigations, experimentation, and technological design.

Biology

Strand: From Molecules to Organisms- Structures and Processes

Standard	Objectives
<i>LS.Bio.1 Analyze how the relationship between structure and function supports life processes within organisms.</i>	LS.Bio.1.1 Construct an explanation to illustrate relationships between structure and function of major macromolecules essential for life.
	LS.Bio.1.2 Carry out investigations to illustrate how enzymes act as catalysts for biochemical reactions and how environmental factors affect enzyme activity.
	LS.Bio.1.3 Use models to explain how the structure of organelles determines its function and supports overall cell processes.
	LS.Bio.1.4 Construct explanations to compare prokaryotic and eukaryotic cells in terms of structures and degree of complexity.
	LS.Bio.1.5 Construct an explanation to summarize how DNA and RNA direct the synthesis of proteins.
Standard	Objectives
<i>LS.Bio.2 Analyze the growth and development processes of organisms.</i>	LS.Bio.2.1 Use models to illustrate how cellular division results in the reproduction, growth, and repair of organisms.
	LS.Bio.2.2 Construct an explanation to illustrate that proteins regulate gene expression resulting in cellular differentiation, specialized cells with specific functions, and uncontrolled cell growth.
Standard	Objectives
<i>LS.Bio.3 Analyze the relationship between biochemical processes and energy use.</i>	LS.Bio.3.1 Carry out investigations to explain how homeostasis is maintained through feedback mechanisms.
	LS.Bio.3.2 Use models to illustrate how photosynthesis transforms light energy into chemical energy.
	LS.Bio.3.3 Use models to illustrate how cellular respiration [aerobic and anaerobic] transforms chemical energy into ATP.

Strand: Ecosystems- Interactions, Energy, and Dynamics	
Standard	Objectives
<i>LS.Bio.4 Analyze the relationships between matter and energy within ecosystems.</i>	LS.Bio.4.1 Use models to illustrate how processes in organisms contribute to the flow of energy and the cycling of matter within an ecosystem.
	LS.Bio.4.2 Use models to explain the relationship between the flow of energy and cycling of matter among organisms in an ecosystem.
Standard	Objectives
<i>LS.Bio.5 Understand ecosystem dynamics, functioning, and resilience.</i>	LS.Bio.5.1 Use mathematics and computational thinking to explain how interactions between organisms (predator/prey, competition) affect carrying capacity and maintain stability in an ecosystem.
	LS.Bio.5.2 Engage in argument from evidence to evaluate various solutions to reduce the impact of human activities on biodiversity and ecosystem health.

Strand: Heredity- Inheritance and Variation of Traits	
Standard	Objectives
<i>LS.Bio.6 Understand genetic mechanisms for variation.</i>	LS.Bio.6.1 Use models to explain how DNA is passed from parents to offspring through the processes of meiosis and fertilization in sexual reproduction.
	LS.Bio.6.2 Construct an explanation to summarize how inheritable genetic variations may result from: new genetic combinations in meiosis, mutations during replication, or mutations caused by environmental factors.
Standard	Objectives
<i>LS.Bio.7 Understand types of inheritance and how the environment can influence traits.</i>	LS.Bio.7.1 Use mathematics and computational thinking to predict the variation and distribution of expressed traits based on: Mendelian inheritance, co-dominance, incomplete dominance, multiple alleles, and sex-linked inheritance.
	LS.Bio.7.2 Analyze and interpret data to explain how polygenic traits result in a wide range of phenotypes.
	LS.Bio.7.3 Construct an explanation to summarize how traits result from interactions of genetic factors (multiple genes and/or alleles) and environmental factors.

Standard	Objectives
LS.Bio.8 Understand applications of genetics and biotechnology.	LS.Bio.8.1 Analyze and interpret data to compare DNA samples.
	LS.Bio.8.2 Obtain and communicate information that summarizes the impact of biotechnology applications on the individual, society, and the environment, including agriculture and medicine.

Strand: Biological Evolution- Unity and Diversity	
Standard	Objectives
LS.Bio.9 Understand natural selection as a mechanism for biological evolution.	LS.Bio.9.1 Analyze and interpret data to summarize how various factors such as geographic isolation, pesticide resistance, antibiotic resistance can influence natural selection.
	LS.Bio.9.2 Construct an explanation to illustrate how common ancestry and biological evolution are supported by multiple lines of empirical evidence.
	LS.Bio.9.3 Use models to illustrate the conditions required for natural selection, including the overproduction of offspring, inherited variation, and the struggle to survive.
	LS.Bio.9.4 Construct an explanation to explain how natural selection leads to adaptations within populations.
Standard	Objectives
LS.Bio.10 Analyze evolutionary relationships among organisms.	LS.Bio.10.1 Construct explanations to illustrate how varying environmental conditions may result in: changes in the number of individuals of a species, the emergence of new species over time, or the extinction of other species.
	LS.Bio.10.2 Use models (including dichotomous keys, scientific nomenclature, cladograms, phylogenetic trees) to identify organisms and exemplify relationships.