

Life Science

The Life Science standards emphasize a more complex understanding of change, cycles, patterns, and relationships in the living world. Students build on basic principles related to these concepts by exploring the cellular organization and the classification of organisms; the dynamic relationships among organisms, populations, communities, and ecosystems; and change as a result of the transmission of genetic information from generation to generation. Inquiry skills at this level include organization and mathematical analysis of data, manipulation of variables in experiments, and identification of sources of experimental error.

The Life Science standards continue to focus on student growth in understanding the nature of science. This scientific view defines the idea that explanations of nature are developed and tested using observation, experimentation, models, evidence, and systematic processes. The nature of science includes the concepts that scientific explanations are based on logical thinking; are subject to rules of evidence; are consistent with observational, inferential, and experimental evidence; are open to rational critique; and are subject to refinement and change with the addition of new scientific evidence. The nature of science includes the concept that science can provide explanations about nature, can predict potential consequences of actions, but cannot be used to answer all questions.

- LS.1 The student will plan and conduct investigations in which
- data are organized into tables showing repeated trials and means;
 - variables are defined;
 - metric units (SI—International System of Units) are used;
 - models are constructed to illustrate and explain phenomena;
 - sources of experimental error are identified;
 - dependent variables, independent variables, and constants are identified;
 - variables are controlled to test hypotheses, and trials are repeated;
 - continuous line graphs are constructed, interpreted, and used to make predictions;
 - interpretations from a set of data are evaluated and defended; and
 - an understanding of the nature of science is developed and reinforced.
- LS.2 The student will investigate and understand that all living things are composed of cells. Key concepts include
- cell structure and organelles (cell membrane, cell wall, cytoplasm, vacuole, mitochondrion, endoplasmic reticulum, nucleus, and chloroplast);
 - similarities and differences between plant and animal cells;
 - development of cell theory; and
 - cell division (mitosis and meiosis).
- LS.3 The student will investigate and understand that living things show patterns of cellular organization. Key concepts include
- cells, tissues, organs, and systems; and
 - life functions and processes of cells, tissues, organs, and systems (respiration, removal of wastes, growth, reproduction, digestion, and cellular transport).
- LS.4 The student will investigate and understand that the basic needs of organisms must be met in order to carry out life processes. Key concepts include
- plant needs (light, water, gases, and nutrients);
 - animal needs (food, water, gases, shelter, space); and
 - factors that influence life processes.

- LS.5 The student will investigate and understand how organisms can be classified. Key concepts include
- the distinguishing characteristics of kingdoms of organisms;
 - the distinguishing characteristics of major animal and plant phyla; and
 - the characteristics of the species.
- LS.6 The student will investigate and understand the basic physical and chemical processes of photosynthesis and its importance to plant and animal life. Key concepts include
- energy transfer between sunlight and chlorophyll;
 - transformation of water and carbon dioxide into sugar and oxygen; and
 - photosynthesis as the foundation of virtually all food webs.
- LS.7 The student will investigate and understand that organisms within an ecosystem are dependent on one another and on nonliving components of the environment. Key concepts include
- the carbon, water, and nitrogen cycles;
 - interactions resulting in a flow of energy and matter throughout the system;
 - complex relationships within terrestrial, freshwater, and marine ecosystems; and
 - energy flow in food webs and energy pyramids.
- LS.8 The student will investigate and understand that interactions exist among members of a population. Key concepts include
- competition, cooperation, social hierarchy, territorial imperative; and
 - influence of behavior on a population.
- LS.9 The student will investigate and understand interactions among populations in a biological community. Key concepts include
- the relationships among producers, consumers, and decomposers in food webs;
 - the relationship between predators and prey;
 - competition and cooperation;
 - symbiotic relationships; and
 - niches.
- LS.10 The student will investigate and understand how organisms adapt to biotic and abiotic factors in an ecosystem. Key concepts include
- differences between ecosystems and biomes;
 - characteristics of land, marine, and freshwater ecosystems; and
 - adaptations that enable organisms to survive within a specific ecosystem.
- LS.11 The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic and change over time (daily, seasonal, and long term). Key concepts include
- phototropism, hibernation, and dormancy;
 - factors that increase or decrease population size; and
 - eutrophication, climate changes, and catastrophic disturbances.

- LS.12 The student will investigate and understand the relationships between ecosystem dynamics and human activity. Key concepts include
- a) food production and harvest;
 - b) change in habitat size, quality, or structure;
 - c) change in species competition;
 - d) population disturbances and factors that threaten or enhance species survival; and
 - e) environmental issues (water supply, air quality, energy production, and waste management).
- LS.13 The student will investigate and understand that organisms reproduce and transmit genetic information to new generations. Key concepts include
- a) the role of DNA;
 - b) the function of genes and chromosomes;
 - c) genotypes and phenotypes;
 - d) factors affecting the expression of traits;
 - e) characteristics that can and cannot be inherited;
 - f) genetic engineering and its applications; and
 - g) historical contributions and significance of discoveries related to genetics.
- LS.14 The student will investigate and understand that organisms change over time. Key concepts include
- a) the relationships of mutation, adaptation, natural selection, and extinction;
 - b) evidence of evolution of different species in the fossil record; and
 - c) how environmental influences, as well as genetic variation, can lead to diversity of organisms.