

Biology

State Standard Number	State Standard Area/Description	Unit Name	Course Topic Description
9.4	Life Science		
9.4.1	Structure and Function in Living Systems		
9.4.1.1	Organisms use the interaction of cellular processes as well as tissues and organ systems to maintain homeostasis.	The Nature of Science and Biology	Section 1
9.4.1.1.1	Explain how cell processes are influenced by internal and external factors, such as pH and temperature, and how cells and organisms respond to changes in their environment to maintain homeostasis.	Photosynthesis	Section 1
9.4.1.1.2	Describe how the functions of individual organ systems are integrated to maintain homeostasis in an organism.	Animal Prganization	All sections
9.4.1.2	Cells and cell structures have specific functions that allow an organism to grow, survive and reproduce.	Cell Structure	Sections 5, 7, 8
9.4.1.2.1	Recognize that cells are composed primarily of a few elements (carbon, hydrogen, oxygen, nitrogen, phosphorus, and sulfur), and describe the basic molecular structures of cells and the primary functions of carbohydrates, lipids, proteins and nucleic acids.	The Nature of Science	Section 2

Biology

9.4.1.2.2	Recognize that the work of the cell is carried out primarily by proteins, most of which are enzymes, and that protein function depends on the amino acid sequence and the shape it takes as a consequence of the interactions between those amino acids.	The Nature of science	Section 2
9.4.1.2.3	Describe how viruses, prokaryotic cells and eukaryotic cells differ in relative size, complexity and general structure.	Cell Structure	Section 1
9.4.1.2.4	Explain the function and importance of cell organelles for prokaryotic and/or eukaryotic cells as related to the basic cell processes of respiration, photosynthesis, protein synthesis and cell reproduction.	Cell Structure Photosynthesis	Section 1 Sections 2 & 3
9.4.1.2.5	Compare and contrast passive transport (including osmosis and facilitated transport) with active transport, such as endocytosis and exocytosis.	Cell Structure	Section 2
9.4.1.2.6	Explain the process of mitosis in the formation of identical new cells and maintaining chromosome number during asexual reproduction.	Cell Structure	Section 3
9.4.2	Interdependence among Living Systems		
9.4.2.1	The interrelationship and interdependence of organisms generate dynamic biological communities in ecosystems.	Population Ecology	Section 2
9.4.2.1.1	Describe factors that affect the carrying capacity of an ecosystem and relate these to population growth.	Population Growth	Section 1

Biology

9.4.2.1.2	Explain how ecosystems can change as a result of the introduction of one or more new species.	Population Growth	Section 1
9.4.2.2	Matter cycles and energy flows through different levels of organization of living systems and the physical environment, as chemical elements are combined in different ways.	Population Growth	Section 3
9.4.2.2.1	Use words and equations to differentiate between the processes of photosynthesis and respiration in terms of energy flow, beginning reactants and end products.	Photosynthesis	Unit Discussion Questions
9.4.2.2.2	Explain how matter and energy in an ecosystem is transformed and transferred among organisms, and how energy is dissipated as heat into the environment.	Population Growth	Section 2
9.4.3	Evolution in Living Systems		
9.4.3.1	Genetic information found in the cell provides information for assembling proteins, which dictate the expression of traits in an individual.	Genetics	Section 1
9.4.3.1.1	Explain the relationships among DNA, genes and chromosomes.	Genetics	Section 1
9.4.3.1.2	In the context of a monohybrid cross, apply the terms phenotype, genotype, allele, homozygous and heterozygous.	Genetics	Section 1

Biology

9.4.3.1.3	Describe the process of DNA replication and the role of DNA and RNA in assembling protein molecules.	Genetics	Section 4
9.4.3.2	Variation within a species is the natural result of new inheritable characteristics occurring from new combinations of existing genes or from mutations of genes in reproductive cells.	Evolution	Section 1
9.4.3.2.1	Use concepts from Mendel's Laws of Segregation and Independent Assortment to explain how sorting and recombination (crossing over) of genes during sexual reproduction (meiosis) increases the occurrence of variation in a species.	Genetics	Section 1
9.4.3.2.2	Use the processes of mitosis and meiosis to explain the advantages and disadvantages of asexual and sexual reproduction.	Cell Structure	Section 3
9.4.3.2.3	Explain how mutations like deletions, insertions, rearrangements or substitutions of DNA segments in gametes may have no effect, may harm, or rarely may be beneficial, and can result in genetic variation within a species.	Genetics	Section 5
9.4.3.3	Evolution by natural selection is a scientific explanation for the history and diversity of life on Earth.	Evolution	Section 1
9.4.3.3.1	Describe how evidence led Darwin to develop the theory of natural selection and common descent to explain evolution.	Evolution	Section 1
9.4.3.3.2	Use scientific evidence, including the fossil record, homologous structures, and genetic and/or biochemical similarities, to show evolutionary relationships among species.	Evolution	Section 1

Biology

9.4.3.3.3	Recognize that artificial selection has led to offspring through successive generations that can be very different in appearance and behavior from their distant ancestors.		
9.4.3.3.4	Explain why genetic variation within a population is essential for evolution to occur.	Evolution	Section 2
9.4.3.3.5	Explain how competition for finite resources and the changing environment promotes natural selection on offspring survival, depending on whether the offspring have characteristics that are advantageous or disadvantageous in the new environment.	Evolution	Section 1
9.4.3.3.6	Explain how genetic variation between two populations of a given species is due, in part, to different selective pressures acting independently on each population and how, over time, these differences can lead to the development of new species.	Evolution	Section 2
9.4.4	Human Interactions with Living Systems		
9.4.4.1	Human activity has consequences on living organisms and ecosystems.	Population Ecology	Section 3
9.4.4.1.1	Describe the social, economic and ecological risks and benefits of biotechnology in agriculture and medicine.	Genetics	Section 6
9.4.4.1.2	Describe the social, economic and ecological risks and benefits of changing a natural ecosystem as a result of human activity.	Population Ecology	Section 3

Biology

9.4.4.1.3	Describe contributions from diverse cultures, including Minnesota American Indian tribes and communities, to the understanding of interactions among humans and living systems.		
9.4.4.2	Personal and community health can be affected by the environment, body functions and human behavior.		
9.4.4.2.1	Describe how some diseases can sometimes be predicted by genetic testing and how this affects parental and community decisions.	Genetics	Section 3
9.4.4.2.2	Explain how the body produces antibodies to fight disease and how vaccines assist this process.	Animal Organization	Section 5
9.4.4.2.3	Describe how the immune system sometimes attacks some of the body's own cells and how some allergic reactions are caused by the body's immune responses to usually harmless environmental substances.	Animal Organization	Section 5
9.4.4.2.4	Explain how environmental factors and personal decisions, such as water pollution, air quality and smoking affect personal and community health.		
9.4.4.2.5	Recognize that a gene mutation in a cell can result in uncontrolled cell division called cancer and how exposure of cells to certain chemicals and radiation increases mutations and thus increases the chance of cancer.	Cell Structure	Section 3