

## Biology

State Standard Number	State Standard Area/Description	Unit Name	Course Topic Description
1	Students will understand that living organisms interact with one another and their environment.		
1.1	Summarize how energy flows through an ecosystem.		
1.1.a	Arrange components of a food chain according to energy flow.	Population Ecology	Disturbance of a Community
1.1.b	Compare the quantity of energy in the steps of an energy pyramid.	Population Ecology	Disturbance of a Community
1.1.c	Describe strategies used by organisms to balance the energy expended to obtain food to the energy gained from the food (e.g., migration to areas of seasonal abundance, switching type of prey based upon availability, hibernation or dormancy).		
1.1.d	Compare the relative energy output expended by an organism in obtaining food to the energy gained from the food (e.g., hummingbird - energy expended hovering at a flower compared to the amount of energy gained from the nectar, coyote - chasing mice to the energy gained from catching one, energy expended in migration of birds to a location with seasonal abundance compared to energy gained by staying in a cold climate with limited food).		
1.1.e	Research food production in various parts of the world (e.g., industrialized societies' greater use of fossil fuel in food production, human health related to food		

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	product).		
1.2	Explain relationships between matter cycles and organisms.		
1.2.a	Use diagrams to trace the movement of matter through a cycle (i.e., carbon, oxygen, nitrogen, water) in a variety of biological communities and ecosystems.	Population Ecology	Biogeochemical Cycles
1.2.b	Explain how water is a limiting factor in various ecosystems.	Population Ecology	Several Basic Controls Govern Population Size
1.2.c	Distinguish between inference and evidence in a newspaper, magazine, journal, or Internet article that addresses an issue related to human impact on cycles of matter in an ecosystem and determine the bias in the article.		
1.2.d	Evaluate the impact of personal choices in relation to the cycling of matter within an ecosystem (e.g., impact of automobiles on the carbon cycle, impact on landfills of processed and packaged foods).	Population Ecology	Disruption of the Biosphere
1.3	Describe how interactions among organisms and their environment help shape ecosystems.		
1.3.a	Categorize relationships among living things according to predator-prey, competition, and symbiosis.	Population Ecology	Several Basic Controls Govern Population Size

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1.3.b	Formulate and test a hypothesis specific to the effect of changing one variable upon another in a small ecosystem.		
1.3.c	Use data to interpret interactions among biotic and abiotic factors (e.g., pH, temperature, precipitation, populations, diversity) within an ecosystem.	Population Ecology	Lab: Biomes
1.3.d	Investigate an ecosystem using methods of science to gather quantitative and qualitative data that describe the ecosystem in detail.	Population Ecology	Lab: Biomes
1.3.e	Research and evaluate local and global practices that affect ecosystems.	Population Ecology	Disruption of the Biosphere
2	Students will understand that all organisms are composed of one or more cells that are made of molecules, come from preexisting cells, and perform life functions.		
2.1	Describe the fundamental chemistry of living cells.		
2.1.a	List the major chemical elements in cells (i.e., carbon, hydrogen, nitrogen, oxygen, phosphorous, sulfur, trace elements).	The Nature of Science Cell Structure	Chemistry of Life Cell Features: Common Features of Cells
2.1.b	Identify the function of the four major macromolecules (i.e., carbohydrates, proteins, lipids, nucleic acids).	The Nature of Science	Carbon Compounds

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2.1.c	Explain how the properties of water (e.g., cohesion, adhesion, heat capacity, solvent properties) contribute to maintenance of cells and living organisms.	The Nature of Science Cell Structure	Water and Solutions: Water and Living Things Water and Solute Movement
2.1.d	Explain the role of enzymes in cell chemistry.	The Nature of Science	Proteins
2.2	Describe the flow of energy and matter in cellular function.		
2.2.a	Distinguish between autotrophic and heterotrophic cells.	The Nature of Science	Characteristics of Life
2.2.b	Illustrate the cycling of matter and the flow of energy through photosynthesis (e.g., by using light energy to combine CO <sub>2</sub> and H <sub>2</sub> O to produce oxygen and sugars) and respiration (e.g., by releasing energy from sugar and O <sub>2</sub> to produce CO <sub>2</sub> and H <sub>2</sub> O).	Photosynthesis	Photosynthesis
2.2.c	Measure the production of one or more of the products of either photosynthesis or respiration.	Photosynthesis	Photosynthesis Lab
2.3	Investigate the structure and function of cells and cell parts.		

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2.3.a	Explain how cells divide from existing cells.	Cell Structure	Cell Division in a Nutshell
2.3.b	Describe cell theory and relate the nature of science to the development of cell theory (e.g., built upon previous knowledge, use of increasingly more sophisticated technology).	The Nature of Science	Science and the Scientific Method Characteristics of Life
2.3.c	Describe how the transport of materials in and out of cells enables cells to maintain homeostasis (i.e., osmosis, diffusion, active transport).	The Nature of Science Cell Structure	Characteristics of Life The Cell Membrane: Structure and Function
2.3.d	Describe the relationship between the organelles in a cell and the functions of that cell.	Cell Structure	Cell Features: Common Features of Cells
2.3.e	Experiment with microorganisms and/or plants to investigate growth and reproduction.		
3	Students will understand the relationship between structure and function of organs and organ systems.		
3.1	Describe the structure and function of organs.		
3.1.a	Diagram and label the structure of the primary components of representative organs in plants and animals (e.g., heart - muscle tissue, valves and chambers; lung - trachea, bronchial, alveoli; leaf - veins, stomata; stem - xylem,	Plant Structure Animal Organization	Plant Organs, Tissues, and Cells Animal Organ Systems and Homeostasis

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	phloem, cambium; root - tip, elongation, hairs; skin - layers, sweat glands, oil glands, hair follicles; ovaries - ova, follicles, corpus luteum).		
3.1.b	Describe the function of various organs (e.g. heart, lungs, skin, leaf, stem, root, ovary).	Plant Structure Animal Organization	Plant Organs, Tissues, and Cells Animal Organ Systems and Homeostasis
3.1.c	Relate the structure of organs to the function of organs.	Plant Structure Animal Organization	Plant Organs, Tissues, and Cells Animal Organ Systems and Homeostasis
3.1.d	Compare the structure and function of organs in one organism to the structure and function of organs in another organism.	Animal Organization	The Circulatory System: Transport Of Materials Within The Body
3.1.e	Research and report on technological developments related to organs.	Animal Organization	The Heart: The System Pump
3.2	Describe the relationship between structure and function of organ systems in plants and animals.		
3.2.a	Relate the function of an organ to the function of an organ system.	Animal Organization	The Circulatory System: Transport Of Materials Within The Body
3.2.b	Describe the structure and function of various organ systems (i.e., digestion, respiration, circulation, protection and support, nervous) and how these systems contribute to homeostasis of the organism.	Animal Organization	Animal Organ Systems and Homeostasis

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3.2.c	Examine the relationships of organ systems within an organism (e.g., respiration to circulation, leaves to roots) and describe the relationship of structure to function in the relationship.	Animal Organization	Animal Organ Systems and Homeostasis
3.2.d	Relate the tissues that make up organs to the structure and function of the organ.	Animal Organization	Animal Tissues
3.2.e	Compare the structure and function of organ systems in one organism to the structure and function in another organism (e.g., chicken to sheep digestive system; fern to peach reproductive system).	Animal Organization	The Circulatory System: Transport Of Materials Within The Body
4	Students will understand that genetic information coded in DNA is passed from parents to offspring by sexual and asexual reproduction. The basic structure of DNA is the same in all living things. Changes in DNA may alter genetic expression.		
4.1	Compare sexual and asexual reproduction.		
4.1.a	Explain the significance of meiosis and fertilization in genetic variation.	Cell Structure	Meiosis and Sexual Reproduction
4.1.b	Compare the advantages/disadvantages of sexual and asexual reproduction to survival of species.		

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4.1.c	Formulate, defend, and support a perspective of a bioethical issue related to intentional or unintentional chromosomal mutations.	Genetics	Biotechnology and the Genetics Revolution
4.2	Predict and interpret patterns of inheritance in sexually reproducing organisms.		
4.2.a	Explain Mendel's laws of segregation and independent assortment and their role in genetic inheritance.	Genetics	The Principle of Segregation The Principle of Independent Assortment
4.2.b	Demonstrate possible results of recombination in sexually reproducing organisms using one or two pairs of contrasting traits in the following crosses: dominance/recessive, incomplete dominance, codominance, and sex-linked traits.	Genetics	Extending Mendel's Rules: The Chromosome Theory of Inheritance
4.2.c	Relate Mendelian principles to modern-day practice of plant and animal breeding.	Genetics	Biotechnology and the Genetics Revolution
4.2.d	Analyze bioethical issues and consider the role of science in determining public policy.	Genetics	Biotechnology and the Genetics Revolution
4.3	Explain how the structure and replication of DNA are essential to heredity and protein synthesis.		
4.3.a	Use a model to describe the structure of DNA.	Genetics	DNA: THE MOLECULAR BASIS OF GENETICS

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4.3.b	Explain the importance of DNA replication in cell reproduction.	Cell Structure	Mitosis Meiosis
4.3.c	Summarize how genetic information encoded in DNA provides instructions for assembling protein molecules.	Genetics	DNA: THE MOLECULAR BASIS OF GENETICS
4.3.d	Describe how mutations may affect genetic expression and cite examples of mutagens.		
4.3.e	Relate the historical events that lead to our present understanding of DNA to the cumulative nature of science knowledge and technology.	Genetics	The Search for the Physical Carrier of Inheritance Biotechnology and the Genetics Revolution
4.3.f	Research, report, and debate genetic technologies that may improve the quality of life (e.g., genetic engineering, cloning, gene splicing).	Genetics	Biotechnology and the Genetics Revolution
5	Students will understand that biological diversity is a result of evolutionary processes.		
5.1	Relate principles of evolution to biological diversity.		
5.1.a	Describe the effects of environmental factors on natural selection.	Evolution	Evolution by Natural Selection

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5.1.b	Relate genetic variability to a species' potential for adaptation to a changing environment.	Evolution	Evolution by Natural Selection
5.1.c	Relate reproductive isolation to speciation.	Evolution	Biogeography: Separation and Divergence
5.1.d	Compare selective breeding to natural selection and relate the differences to agricultural practices.		
5.2	Cite evidence for changes in populations over time and use concepts of evolution to explain these changes.		
5.2.a	Cite evidence that supports biological evolution over time (e.g., geologic and fossil records, chemical mechanisms, DNA structural similarities, homologous and vestigial structures).	Evolution	Evidence for Evolution
5.2.b	Identify the role of mutation and recombination in evolution.	Evolution	Mutation Rate
5.2.c	Relate the nature of science to the historical development of the theory of evolution.	Evolution	Pre-Renaissance Thought
5.2.d	Distinguish between observations and inferences in making interpretations related to evolution (e.g., observed similarities and differences in the beaks of Galapagos finches leads to the inference that they evolved from a		

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	common ancestor; observed similarities and differences in the structures of birds and reptiles leads to the inference that birds evolved from reptiles).		
5.2.e	Review a scientific article and identify the research methods used to gather evidence that documents the evolution of a species.		
5.3	Classify organisms into a hierarchy of groups based on similarities that reflect their evolutionary relationships.		
5.3.a	Classify organisms using a classification tool such as a key or field guide.	Biological Diversity	Taxonomy
5.3.b	Generalize criteria used for classification of organisms (e.g., dichotomy, structure, broad to specific).	Biological Diversity	Taxonomy
5.3.c	Explain how evolutionary relationships are related to classification systems.	Biological Diversity	Taxonomy
5.3.d	Justify the ongoing changes to classification schemes used in biology.		