

Science Standard 6 Life Processes

The natural world is defined by organisms and life processes which conform to principles regarding conservation and transformation of matter and energy. Living organisms use matter and energy to build their structures and conduct their life processes, have mechanisms and behaviors to regulate their internal environments and to respond to changes in their surroundings. Knowledge about life processes can be applied to improving human health and well being.

Strand	Grades K-3	Grades 4-5	Grades 6-8	Grades 9-12
<p><u>Structure/Function Relationship</u></p> <p>Enduring Understanding: Living systems, from the organismic to the cellular level, demonstrate the complementary nature of structure and function.</p> <p>Essential Question: How does structure relate to function in living systems from the cellular to the organismic level?</p>	<p>A. Plants and animals are similar to and different from each other in observable structures and behavior. These characteristics distinguish them from each other and from nonliving things. Level: Essential</p> <p>B. Each plant or animal has different structures that serve different functions in growth, survival and reproduction. Level: Essential</p> <p>C. In animals the skeletal-muscular system provides structure, support and enables movement. Level: Essential</p>	<p>A. Structures that function for similar purposes in living things may have different appearances. Level: Essential</p> <p>B. The digestive system has major structures that function to break down food for use in the body. The major parts of the digestive system include the mouth, esophagus, stomach, small intestine, and large intestine. Level: Compact</p> <p>C. Organisms can be grouped based on similarities and differences in their structures and functions. These may include characteristics such as appendages, roots and leaves of plants, or the presence or lack of a backbone. Level: Essential</p>	<p>A. Living organisms share common characteristics that distinguish them from non-living, dead, and dormant things. They grow, consume nutrients, exchange gases, respond to stimuli, reproduce, need water, eliminate waste, and are composed of cell(s). Level: Essential</p> <p>B. Living systems in all kingdoms demonstrate the complementary nature of structure and function. Important levels of organization for structure and function include cells, tissues, organs, organ systems, and organisms. Level: Important</p> <p>C. Most organisms are single celled while others are multi-cellular. Multi-cellular organisms consist of individual cells that cannot survive independently, while single-celled organisms are composed of one cell that can survive independently. Level: Important</p> <p>D. The cell is the fundamental unit of life. Cells have basic needs for survival. They use energy, consume materials, require water, eliminate waste, and reproduce. Level: Essential</p>	<p>A. In order to establish and maintain their complex organization and structure, organisms must obtain, transform, and transport matter and energy, eliminate waste products, and coordinate their internal activities. Level: Essential</p> <p>B. Cells take highly varied forms in different plants, animals, and microorganisms. Structural variations among cells determine the function each cell performs. Level: Essential</p> <p>C. Cells have distinct and separate structures (organelles), which perform and monitor processes essential for survival of the cell (e.g., energy use, waste disposal, synthesis of new molecules, and storage of genetic material). The highly specific function of each organelle is directly related to its structure. Level: Important</p> <p>D. The cell membrane is dynamic and interacts with internal membranous structures as materials are transported into and out of the cell. Level: Essential</p>

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<p><u>Structure/Function</u> <u>Relationship</u> <i>(Continued from previous page)</i></p>			<p>E. Most cells contain a set of observable structures called organelles which allow them to carry out life processes. Major organelles include vacuoles, cell membrane, nucleus, and mitochondria. Plant cells have a cell wall and chloroplasts. Level: Important</p> <p>F. The human body has systems that perform functions necessary for life. Major systems of the human body include the digestive, respiratory, reproductive, and circulatory systems. Level: Essential</p>	<p>E. The transport of materials across the membrane can be passive (does not require the expenditure of cellular energy), or active (requires the expenditure of cellular energy) depending upon membrane structure and concentration gradients. Level: Important</p> <p>F. Cells store and use information to guide their functions. DNA molecules in each cell carry coded instructions for synthesizing protein molecules. The protein molecules have important structural and regulatory functions. Level: Essential</p> <p>G. Humans have a nervous system composed of a brain and specialized cells that conduct signals rapidly through the long cell extensions that make up nerves. The nerve cells communicate with each other by secreting specific molecules (neurotransmitters). Level: Compact</p>

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<p><u>Structure/Function Relationship</u> <i>(Continued from previous page)</i></p>				<p>H. In multi-cellular organisms, cells perform specialized functions as parts of sub-systems (e.g., tissues, organs, and organ systems), which work together to maintain optimum conditions for the benefit of the whole organism. Level: Important</p> <p>I. The endocrine system consists of glands which secrete chemical messengers (hormones) that are transported via the circulatory system and act on body structures to maintain homeostasis. Level: Compact</p> <p>J. The immune system consists of cells, organs, and secretions that protect the organism from toxins, irritants, and pathogens. Level: Compact</p>

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<p><u>Matter and Energy Transformations</u></p> <p>Enduring Understanding: All organisms transfer matter and convert energy from one form to another. Both matter and energy are necessary to build and maintain structures within the organism.</p> <p>Essential Question: How is matter transferred and energy transferred/transformed in living systems?</p>	<p>A. Plants and animals are living things. All living things have basic needs for survival including air, water, food (nutrients), space, shelter, and light. Level: Essential</p> <p>B. In addition to basic needs for survival, living things have needs specific to the organism such as temperature range and food requirements. Level: Important</p>	<p>A. Plants need the Sun's energy to grow and survive. Level: Essential</p> <p>B. Animals need food to provide materials and energy for life which they derive directly or indirectly from plants. Level: Essential</p>	<p>A. All organisms require energy. A general distinction among organisms is that plants use solar energy to make their own food (sugar) and animals acquire energy directly or indirectly from plants. Level: Essential</p> <p>B. Plants use the energy from sunlight, carbon dioxide, and water to produce sugars (photosynthesis). Plants can use the food (sugar) immediately or store it for later use. Level: Essential</p> <p>C. Most living things use sugar (from food) and oxygen to release the energy needed to carry out life processes (cellular respiration). Other materials from food are used for building and repairing cell parts. Level: Important</p>	<p>A. Cells carry out a variety of chemical transformations (i.e., cellular respiration, photosynthesis, and digestion) which allow conversion of energy from one form to another, the breakdown of molecules into smaller units, and the building of larger molecules from smaller ones. Most of these transformations are made possible by protein catalysts called enzymes. Level: Essential</p> <p>B. Plant cells contain chloroplasts, which convert light energy into chemical energy through the process of photosynthesis. This chemical energy is used by the plants to convert carbon dioxide and water into glucose molecules, that may be used for energy or to form plant structures. Photosynthesis adds oxygen to the atmosphere and removes carbon dioxide. Level: Essential</p> <p>C. All organisms, including plants, use the process of cellular respiration to transform stored energy in food molecules into usable energy. The energy produced is stored in the form of ATP and is used by organisms to conduct their life processes. Cellular respiration may require oxygen and adds carbon dioxide to the atmosphere. Level: Essential</p> <p>D. Photosynthesis and cellular respiration are complementary processes resulting in the flow of energy and the cycling of matter in ecosystems. Level: Essential</p>

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<p><u>Regulation and Behavior</u></p> <p>Enduring Understanding: Organisms respond to internal and external cues, which allow them to survive.</p> <p>Essential Question: How do responses to internal and external cues aid in an organism's survival?</p>	<p>A. Senses help humans and other organisms detect internal and external cues. Level: Essential</p> <p>B. The brain receives signals from parts of the body via the senses. In response, the brain sends signals to parts of the body to influence reactions. Level: Essential</p>	<p>A. An organism displays behaviors in response to internal cues, such as hunger, and external cues, such as light, temperature, or interaction with living things. Level: Essential</p> <p>B. There are similarities and differences in how organisms respond to internal and external cues. These behaviors may include strategies for acquiring food, building shelters, or evading predators. Level: Important</p>	<p>A. Regulation of an organism's internal environment involves sensing external changes in the environment and responding physiologically to keep conditions within the range required for survival (e.g., increasing heart rate with exertion). Level: Compact</p>	<p>A. The endocrine, nervous, and immune systems coordinate and help maintain homeostasis in humans and other organisms. Level: Compact</p> <p>B. Multi-cellular animals have nervous systems that generate behavioral responses. These responses result from interactions between organisms of the same species, organisms of different species, and from environmental changes. Level: Compact</p>

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<p><u>Life Processes and Technology Application</u></p> <p>Enduring Understanding: Grades K-8: The life processes of organisms are affected by their interactions with each other and their environment, and may be altered by human manipulation. Grades 9-12: The health of humans and other organisms is affected by their interactions with each other and their environment, and may be altered by human manipulation.</p> <p>Essential Question: What can we do to benefit the health of humans and other organisms?</p>	<p>A. Technology expands the range of human senses. Level: Compact</p> <p>B. Humans use devices and specialized equipment to ensure safety and to improve their quality of life (e.g., goggles, glasses, hearing aids, and wheelchairs). Level: Compact</p> <p>C. The ability of an organism to meet its needs for survival is dependent upon its environment. Manipulation of the environment can positively or negatively affect the well being of various organisms that live there. Level: Important</p>	<p>A. The development of safety devices and protective equipment has helped in the prevention of injuries. Level: Compact</p> <p>B. Short term and long term studies are used to determine the effects of environmental changes (natural and man-made) on the health of the organisms within that environment. Level: Important</p>	<p>A. Technological advances in medicine and improvements in hygiene have helped in the prevention and treatment of illness. Level: Important</p> <p>B. The functioning and health of organisms are influenced by many factors (i.e., heredity, diet, lifestyle, bacteria, viruses, parasites, and the environment). Certain body structures and systems function to protect against disease and injury. Level: Important</p> <p>C. The environment may contain dangerous levels of substances in the water and soil that are harmful to organisms. Careful monitoring of these is important for healthy life processes. Level: Compact</p>	<p>A. Certain chemicals, pathogens, and high-energy radiation seriously impair normal cell functions and the health of the organism. Level: Compact</p> <p>B. The scientific investigation of cellular chemistry enables the biotechnology industry to produce medicines, foods, and other products for the benefit of society. Level: Essential</p> <p>C. Many drugs exert their effects by mimicking or increasing the production or destruction of neurotransmitters. Level: Compact</p> <p>D. Biotechnology is a growing international field of research and industry. Many scientists, including those in Delaware, conduct cutting-edge research in biotechnology. Level: Compact</p>