



Science

High School Biology

	What students will know and be able to do:	Standard
Biochemistry	<ul style="list-style-type: none"> Recognize that biological organisms are composed primarily of few elements, the six most common being C, H, N, O, P, and S. Students study the structure of organic molecules and demonstrate an understanding of why these six elements are the most significant in living organisms. Describe the basic molecular structures and primary functions of the four major categories of organic molecules: carbohydrates, lipids, proteins, nucleic acids. Identify the major roles these organic molecules play in living organisms. Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Students should be able to identify factors, such as pH and temperature, that have an effect on enzymes. 	1.1-1.3
Cell Biology	<ul style="list-style-type: none"> Relate cell parts/organelles (plasma membrane, nuclear envelope, nucleus, nucleolus, cytoplasm, mitochondrion, endoplasmic reticulum, Golgi apparatus, lysosome, ribosome, vacuole, cell wall, chloroplast, cytoskeleton, centriole, cilium, flagellum, pseudopod) to their functions. Explain the role of cell membranes as highly selective barriers (diffusion, osmosis, facilitated diffusion, active transport). Compare and contrast, at the cellular level, the general structures and degrees of complexity of prokaryotes and eukaryotes. Use cellular evidence (e.g., cell structure, cell number, cell reproduction) and modes of nutrition to describe the kingdoms (Archaeobacteria, Eubacteria, Protista, Fungi, Plantae, Animalia). Identify the reactants, products, and basic purposes of photosynthesis and cellular respiration. Explain the interrelated nature of photosynthesis and cellular respiration in the cells of photosynthetic organisms in a self-generated diagram. Explain the important role that the high energy molecule, ATP, serves in metabolism. Describe the cell cycle and the process of mitosis. Explain the role of mitosis in the formation of new cells, and its importance in maintaining chromosome number during asexual reproduction. Describe how the process of meiosis results in the formation of haploid cells, explain the importance of 	2.1-2.8

	<p>this process in sexual reproduction, and describe how gametes combine to form diploid zygotes in the process of fertilization.</p> <ul style="list-style-type: none"> • Compare and contrast viruses and cells in terms of genetic material and reproductive mechanisms. 	
Genetics	<ul style="list-style-type: none"> • Describe the basic structure (double helix, sugar/phosphate backbone, linked by complementary nucleotide pairs) of DNA, and describe its function in genetic inheritance. • Understand the importance of DNA and the role of science in paternity, crime solving, isolating disease-causing agents and disease identification, etc. • Describe the basic process of DNA replication and transmission and how they relate to conservation of the genetic code. • Explain the basic processes of transcription and translation, and how they result in the expression of genes. • Distinguish among the end products of replication, transcription, and translation. • Explain how mutations in the DNA sequence of a gene may or may not result in phenotypic change in an organism. • Explain how mutations in gametes may result in phenotypic changes in offspring. • Distinguish among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, codominant, sex-linked, polygenic, incomplete dominance, multiple alleles). • Describe how Mendel's laws of segregation and independent assortment can be observed through patterns of inheritance (e.g., dihybrid crosses). • Use a Punnett square to determine the probabilities for genotype and phenotype combinations in monohybrid crosses. 	3.1-3.6
Anatomy and Physiology	<ul style="list-style-type: none"> • Recognize that the structure of each body component relates directly to its function (e.g., alveoli in the lungs provide enormous surface area to facilitate gas exchange). • Recognize the importance of homeostasis in maintaining health. • Recognize that all of the body's systems continually interact to maintain homeostasis. • Describe the basic function of a physiological feedback loop. • Explain generally how the digestive system (mouth, pharynx, esophagus, stomach, small and large intestines, rectum) converts macromolecules from food into smaller molecules that can be used by cells for energy, growth and repair. • Explain how the circulatory system (heart, arteries, veins, capillaries, red blood cells) transports nutrients and oxygen to cells and removes cell wastes. • Describe how the kidneys and the liver are closely 	4.1-4.8

	<p>associated with the circulatory system as they remove waste from the blood. Recognize that kidneys remove nitrogenous wastes and the liver removes many other toxic compounds from blood.</p> <ul style="list-style-type: none"> • Explain how the respiratory system (nose, pharynx, larynx, trachea, bronchi, lungs, alveoli) functions in gas exchange (oxygen and carbon dioxide). • Explain how the nervous system (brain, spinal cord, sensory and motor neurons) mediates communication between the body and the environment (external and internal) and among different parts of the body. • Explain how the muscular/skeletal system (skeletal, smooth and cardiac muscles, bones, cartilage, ligaments, tendons) works with other systems to support the body and allow for movement. Recognize that bones produce blood cells. • Understand basic functions of the immune system • Identify the basic unit of the nervous system, the neuron, and explain its function generally and how its function is affected by alcohol and drugs. • Understand the role of neuroplasticity in addiction and recovery. • Recognize that communication among cells is required for coordination of body functions and that this communication can be neural (nervous system) or chemical (endocrine system). The nerves communicate via electrochemical signals, hormones circulate through the blood, and some cells produce signals to communicate only with nearby cells. • Recognize that the sexual reproductive system allows organisms to produce offspring that receive half of their genetic information from their mother and half from their father, and that sexually produced offspring resemble, but are not identical to, their parents. 	
<p>Evolution and Biodiversity</p>	<ul style="list-style-type: none"> • Explain how evolution is demonstrated by evidence from the fossil record, comparative anatomy, genetics, molecular biology, and examples of natural selection. • Describe “species” as reproductively distinct groups of organisms. Recognize that species are further classified into a hierarchical taxonomic system (kingdom, phylum, class, order, family, genus, species) based on morphological, behavioral, and molecular similarities. Describe the role that geographic, temporal and behavioral isolation can play in speciation. • Explain how evolution through natural selection can result in changes in biodiversity through the increase or decrease of genetic diversity within a population. 	<p>5.1-5.3</p>

Ecology	<ul style="list-style-type: none"> • Explain how water, carbon, and nitrogen cycle between abiotic resources and organic matter in an ecosystem, and how oxygen cycles through photosynthesis and respiration. • Identify food webs and distinguish among producers, consumers and decomposers, and explain the transfer of energy through trophic levels. • Explain how birth, death, immigration, and emigration influence population size. • Analyze changes in population size and biodiversity (speciation and extinction) that result from the following: natural causes, changes in climate, human (anthropogenic) activity, and the introduction of invasive, non-native species. • Describe how relationships among organisms (predation, parasitism, competition, commensalism, mutualism) add to the complexity of biological communities. • Examine the effects of population, climate change, pollution, and habitat destruction impact biodiversity and ecological communities. • Understand how changes in an ecosystem affect all organisms in that system, including humans. 	6.1-6.4
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