

Biology: High School

Cells and Cell Processes

1 Basic Biological Principles **BIO.A.1**

- 1 Explain the characteristics common to all organisms. **BIO.A.1.1**
 - 1 Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms. **BIO.A.1.1.1**
 - 2 Describe relationships between structure and function at biological levels of organization. **BIO.A.1.2**
 - 1 Compare cellular structures and their functions in prokaryotic and eukaryotic cells. **BIO.A.1.2.1**
 - 2 Describe and interpret relationships between structure and function at various levels of biological organization (i.e., organelles, cells, tissues, organs, organ systems, and multicellular organisms). **BIO.A.1.2.2**

2 The Chemical Basis for Life **BIO.A.2**

- 1 Describe how the unique properties of water support life on Earth. **BIO.A.2.1**
 - 1 Describe the unique properties of water and how these properties support life on Earth (e.g., freezing point, high specific heat, cohesion). **BIO.A.2.1.1**
 - 2 Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e., atoms, molecules, and macromolecules). **BIO.A.2.2**
 - 1 Explain how carbon is uniquely suited to form biological macromolecules. **BIO.A.2.2.1**
 - 2 Describe how biological macromolecules form from monomers. **BIO.A.2.2.2**
 - 3 Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms. **BIO.A.2.2.3**
 - 3 Explain how enzymes regulate biochemical reactions within a cell. **BIO.A.2.3**
 - 1 Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction **BIO.A.2.3.1**
 - 2 Explain how factors such as pH, temperature, and concentration levels can affect enzyme function. **BIO.A.2.3.2**

3 Bioenergetics **BIO.A.3**

- 1 Identify and describe the cell structures involved in processing energy. **BIO.A.3.1**
 - 1 Describe the fundamental roles of plastids (e.g., chloroplasts) and mitochondria in energy transformations. **BIO.A.3.1.1**
- 2 Identify and describe how organisms obtain and transform energy for their life processes. **BIO.A.3.2**
 - 1 Compare the basic transformation of energy during photosynthesis and cellular respiration. **BIO.A.3.2.1**
 - 2 Describe the role of ATP in biochemical reactions. **BIO.A.3.2.2**

4 Homeostasis and Transport **BIO.A.4**

- 1 Identify and describe the cell structures involved in transport of materials into, out of, and throughout a cell. **BIO.A.4.1**
 - 1 Describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or protective barrier for a cell. **BIO.A.4.1.1**
 - 2 Compare the mechanisms that transport materials across the plasma membrane (i.e., passive transport—diffusion, osmosis, facilitated diffusion; and active transport—pumps, endocytosis, exocytosis). **BIO.A.4.1.2**
 - 3 Describe how membrane-bound cellular organelles (e.g., endoplasmic reticulum, Golgi apparatus) facilitate the transport of materials within a cell. **BIO.A.4.1.3**
- 2 Explain mechanisms that permit organisms to maintain biological balance between their internal and external environments. **BIO.A.4.2**
 - 1 Explain how organisms maintain homeostasis (e.g., thermoregulation, water regulation, oxygen regulation). **BIO.A.4.2.1**

Continuity and Unity of Life

1 Cell Growth and Reproduction **BIO.B.1**

- 1 Describe the three stages of the cell cycle: interphase, nuclear division, cytokinesis. **BIO.B.1.1**
 - 1 Describe the events that occur during the cell cycle: interphase, nuclear division (i.e., mitosis or meiosis), cytokinesis. **BIO.B.1.1.1**
 - 2 Compare the processes and outcomes of mitotic and meiotic nuclear divisions. **BIO.B.1.1.2**
- 2 Explain how genetic information is inherited. **BIO.B.1.2**
 - 1 Describe how the process of DNA replication results in the transmission and/or conservation of genetic information. **BIO.B.1.2.1**
 - 2 Explain the functional relationships between DNA, genes, alleles, and chromosomes and their roles in inheritance. **BIO.B.1.2.2**

2 Genetics **BIO.B.2**

- 1 Compare Mendelian and non-Mendelian patterns of inheritance. **BIO.B.2.1**
 - 1 Describe and/or predict observed patterns of inheritance (i.e., dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles). **BIO.B.2.1.1**
 - 2 Describe processes that can alter composition or number of chromosomes (i.e., crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion). **BIO.B.2.1.2**
- 2 Explain the process of protein synthesis (i.e., transcription, translation, and protein modification). **BIO.B.2.2**
 - 1 Describe how the processes of transcription and translation are similar in all organisms **BIO.B.2.2.1**
 - 2 Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins. **BIO.B.2.2.2**
- 3 Explain how genetic information is expressed. **BIO.B.2.3**
 - 1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift). **BIO.B.2.3.1**
- 4 Apply scientific thinking, processes, tools, and technologies in the study of genetics. **BIO.B.2.4**
 - 1 Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture (e.g., selective breeding, gene splicing, cloning, genetically modified organisms, gene therapy). **BIO.B.2.4.1**

3 Theory of Evolution **BIO.B.3**

- 1 Explain the mechanisms of evolution. **BIO.B.3.1**
 - 1 Explain how natural selection can impact allele frequencies of a population. **BIO.B.3.1.1**
 - 2 Describe the factors that can contribute to the development of new species (e.g., isolating mechanisms, genetic drift, founder effect, migration). **BIO.B.3.1.2**
 - 3 Explain how genetic mutations may result in genotypic and phenotypic variations within a population. **BIO.B.3.1.3**
- 2 Analyze the sources of evidence for biological evolution. **BIO.B.3.2**
 - 1 Interpret evidence supporting the theory of evolution (i.e., fossil, anatomical, physiological, embryological, biochemical, and universal genetic code). **BIO.B.3.2.1**
- 3 Apply scientific thinking, processes, tools, and technologies in the study of the theory of evolution. **BIO.B.3.3**
 - 1 Distinguish between the scientific terms: hypothesis, inference, law, theory, principle, fact, and observation. **BIO.B.3.3.1**

4 Ecology BIO.B.4

- 1 Describe ecological levels of organization in the biosphere. BIO.B.4.1
 - 1 Describe the levels of ecological organization (i.e., organism, population, community, ecosystem, biome, and biosphere). BIO.B.4.1.1
 - 2 Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems. BIO.B.4.1.2
- 2 Describe interactions and relationships in an ecosystem. BIO.B.4.2
 - 1 Describe how energy flows through an ecosystem (e.g., food chains, food webs, energy pyramids). BIO.B.4.2.1
 - 2 Describe biotic interactions in an ecosystem (e.g., competition, predation, symbiosis). BIO.B.4.2.2
 - 3 Describe how matter recycles through an ecosystem (i.e., water cycle, carbon cycle, oxygen cycle, and nitrogen cycle). BIO.B.4.2.3
 - 4 Describe how ecosystems change in response to natural and human disturbances (e.g., climate changes, introduction nonnative species, pollution, fires). BIO.B.4.2.4
 - 5 Describe the effects of limiting factors on population dynamics and potential species extinction. BIO.B.4.2.5