Pennsylvania Keystone Exams

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

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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