SPRING GROVE AREA SCHOOL DISTRICT

PLANNED COURSE OVERVIEW

Course Title: Biology Honors	**Length of Course:** Half year
Grade Level(s): 9	**Periods Per Cycle:** 6
Units of Credit: 1	**Length of Period:** 84 Minutes
Classification: Core	**Total Instructional Time:** 126 Hours

Course Description

This rigorous course is designed to prepare students for success on the Biology Keystone Exam. Course content is aligned with the Pennsylvania Integrated Standards for Science, Environment, and Ecology. It is designed to focus on depth of understanding as it relates to the concepts of biological science. Themes covered are basic biological principles, the chemical basis for life, bioenergetics, homeostasis and transport, cell growth and reproduction, genetics, theory of evolution, and ecology. Corresponding laboratory activities are incorporated into each unit of study. This is a laboratory science.

Instructional Strategies, Learning Practices, Activities, and Experiences

Bell Ringers Closure Appropriately Chunked Lessons	Laboratory Activities Direct Instruction Differentiated Instruction	Keystone-Based Curriculum Keystone-Based Timeline with Appropriate Depth of Content

Assessments

Teacher Specific Assessments (Quizzes, Unit Exams, Closure, etc.)	CDT Benchmark Data	Keystone Exam

Materials/Resources

Biology Textbook	Teacher Provided Materials (Notes, Labs, Remediation, Enrichment Materials)	Keystone Specific Review Materials (Example Questions, Terminology, etc.)

Adopted: 4/20/88
Revised: 11/20/91; 7/15/98; 11/15/01; 8/20/07; 5/19/14; 5/22/23
https://springgroveareascho.sharepoint.com/sites/PrivateSGASD/Shared Documents/AASG/NEWCURR/SCIENCE/2023/Grade 9/Biology Honors/Biology Honors_Overview.docx

I. Basic Biological Principles	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Characteristics of Life B. Biological Levels of Organization	PA Standards: Life Science – Structure and Function: 2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. (NGSS Standard HS-LS1-2) 3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. (NGSS Standard HS-LS1-3) PA Keystone Exam Assessment Anchors and Eligible Content: 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.1.2: 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.1.2.2: Describe and interpret relationships between structure and function at various levels of biological organization.

II. Chemical Basis of Life	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Chemistry of Life a. Specific to Water b. Specific to Organic Chemistry c. Functionality of Carbon d. Specific to Enzymatic Structure and Functions	PA Standards: Life Science - Matter and Energy in Organisms and Ecosystems: 2. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. (NGSS Standard HS-LS1-6) PA Keystone Exam Assessment Anchors and Eligible Content: 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.2.2: 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 molecules. BIO.A.2.2.2: Describe how biological macromolecules form from monomers. BIO.A.2.2.3: Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms. BIO.A.2.3: 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.2.3.2: Explain how factors such as pH, temperature, and concentration levels can affect enzyme function.

III. Bioenergetics	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Photosynthesis B. Cellular Respiration	PA Standards: Life Science - Matter and Energy in Organisms and Ecosystems: 1. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. (NGSS Standard HS-LS1-5) 3. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. (NGSS Standard HS-LS1-7) 4. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. (NGSS Standard HS-LS2-3) 6. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. (NGSS Standard HS-LS2-5) PA Keystone Exam Assessment Anchors and Eligible Content: 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.3.2: 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.3.2.2: Describe the role of ATP in biochemical reactions.

IV. Homeostasis and Transport	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Cellular Membrane B. Passive Transport C. Active Transport D. Vesicle Transport E. Cellular Transport F. Homeostasis	PA Standards: Life Science- Structure and Function: 3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. (NGSS Standard HS-LS1-3) PA Keystone Exam Assessment Anchors and Eligible Content: 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.4.1.2: 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.4.1.3: Describe how membrane-bound cellular organelles (e.g., endoplasmic reticulum, Golgi apparatus) facilitate the transport of materials within a cell. BIO.A.4.2: 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)

V. Cell Growth and Reproduction	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Cell Cycle B. Mitosis C. Meiosis D. DNA Structure E. DNA Replication F. RNA Structure G. Protein Synthesis H. Chromosome Structure	PA Standards: Life Science- Structure and Function: 1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. (NGSS Standard HS-LS1-1) Life Science- Inheritance and Variation of Traits: 1. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. (NGSS Standard HS-LS1-4) 3. Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. (NGSS Standard HS-LS3-2) PA Assessment Anchors and Eligible Content: BIO.B.1.1: Describe the three stages of the cell cycle: interphase, nuclear division, cytokinesis. BIO.B.1.1: Describe the events that occur during the cell cycle: interphase, nuclear division (mitosis or meiosis), cytokinesis. BIO.B.1.2: Compare the processes and outcomes of mitotic and meiotic nuclear divisions. BIO.B.1.2: 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.1.2.2: Explain the functional relationships between DNA, genes, alleles, and chromosomes and their roles in inheritance.

VI. Genetics	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Genetics B. Genotypes C. Phenotypes D. Monohybrid/Dihybrid Crosses E. Single/Multiple Allele Combinations F. Chromosome Function G. Protein Synthesis H. Genetic Abnormality I. Genetic Technology J. Science and Ethics	PA Standards: Life Science- Inheritance and Variation of Traits: 2. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. (NGSS Standard HS-LS3-1) 3. Make and defend a claim based on evidence that inheritable genetic variations may result from (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. (NGSS Standard HS-LS3-2) 4. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. (NGSS Standard HS-LS3-3) PA Keystone Exam Assessment Anchors and Eligible Content: 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.2.1.2: Describe processes that can alter composition or number of chromosomes. (i.e., crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion) BIO.B.2.2: 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.2.2.2: Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins. BIO.B.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, frameshift) BIO.B.2.4: 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)

VII. Theory of Evolution	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Natural Selection B. Genetic Theory C. Evolution D. Evolutionary Evidence E. Scientific Method	PA Standards: Life Science- Natural Selection and Evolution: 1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. (NGSS Standard HS-LS4-1) 2. Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. (NGSS Standard HS-LS4-2) 3. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. (NGSS Standard HS-LS4-3) 4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations. (NGSS Standard HS-LS4-4) 5. Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species. (NGSS Standard HS-LS4-5) Life Science- Interdependent Relationships in Ecosystems: 5. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. (NGSS Standard HS-LS2-8) Life Science- Inheritance and Variation of Traits: 4. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. (NGSS Standard HS-LS3-3)

Theory of Evolution (Continued)	
Content/Key Concepts	**OBJECTIVES/STANDARDS**
	PA Keystone Exam Assessment Anchors and Eligible Content: 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.3.1.2: Describe the factors that can contribute to the development of new species. (e.g., isolating mechanisms, genetic drift, founder effect, migration) BIO.B.3.1.3: Explain how genetic mutations may result in genotypic and phenotypic variations within a population. BIO.B.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.3.3: 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.

VIII. Ecology	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Environmental Organization B. Biotic Factors C. Abiotic Factors D. Transfer of Energy E. Biotic Interactions F. Matter Recycling G. Population Dynamics	PA Standards: Life Science- Interdependent Relationships in Ecosystems: 1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. (NGSS Standard HS-LS2-1) 2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. (NGSS Standard HS-LS2-2) 3. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. (NGSS Standard HS-LS2-6) 4. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* (NGSS Standard HS-LS2-7) 5. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. (NGSS Standard HS-LS2-8) 6. Create or revise a simulation to test a solution to mitigate the adverse impacts of human activity on biodiversity.* (NGSS Standard HS-LS4-6) Life Science- Matter and Energy: 2. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. (NGSS Standard HS-LS2-3) 5. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. (NGSS Standard HS-LS2-4) 6. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. (NGSS Standard HS-LS2-5)

ECOLOGY CONTINUED	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
	PA Assessment Anchors and Eligible Content: 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.4.1.2: Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems. BIO.B.4.2: 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.4.2.2: Describe biotic interactions in an ecosystem. (e.g., competition, predation, symbiosis) BIO.B.4.2.3: Describe how matter recycles through an ecosystem. (i.e., water cycle, carbon cycle, oxygen cycle, and nitrogen cycle) BIO.B.4.2.4: Describe how ecosystems change in response to natural and human disturbances. (e.g., climate changes, introduction of nonnative species, pollution, fires) BIO.B.4.2.5: Describe the effects of limiting factors on population dynamics and potential species extinction.