Fair Lawn

Public Schools

Fair Lawn, NJ

Advanced Placement Biology

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2015

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AP Biology is a high school science class developed by the Fair Lawn Schools high school science faculty and aligned to the 2009 NJCCCS and correlated to the Common Core State Standards for Literacy & Math.

Science Department

Fair Lawn School District

Committee Credits

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Advanced Placement Biology

I. Course Synopsis

This course is designed based on the four big ideas put forth by the College Board:

The process of evolution drives the diversity and unity of life

Biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.

Living systems store, retrieve, transmit and respond to information essential to life processes.

Biological systems interact, and these systems and their interactions possess complex properties.

The emphasis is on students making connections between these big ideas relating biological concepts throughout the course. This course is the equivalent of an introductory college-level biology course and is designed to prepare students for the AP Biology Exam.

The class meets three days a week for 45 minutes and two days a week for 90 minutes. The textbook for the course is the seventh edition of Neil A. Campbell and Jane B. Reece's *Biology*. Numerous hands-on labs and activities will be conducted in order to develop students' inquiry, higher order thinking and lab skills. Labs will be taken from *AP Biology Investigative Labs: An Inquiry-Based Approach.*

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II. Philosophy & Rationale

AP Biology course is designed to actively engage students in the process of science through clas assignments and discussions which inform their laboratory experiences. The study of biology is important to the understanding of ourselves and the environment in which we live. Through new discoveries, biology is an ever changing course that allows the student to see how the acquisition of this knowledge can influence future generations. To emphasis this, journal article readings will be used in order to expose students to present day hypotheses in order to develop better designed experimental investigation. Students will be held to high expectations and mature responsibilities just like a college freshman taking Introduction to Biology.

III. Scope & Sequence

Molecules, Cells & Energy			
	Topics	Readings	Activity/Labs
UNIT 1	**I. Biochemistry** Polarity of water & its importance to biological systems Carbon's role in the molecular diversity of life Monomers, polymers & reactions involved in building & breaking them down considering polar/nonpolar interactions Various level of structures in protein & carbohydrates Enzyme structure as a special protein Cohesion, adhesion, specific heat of water & its importance to biological systems Acids, bases, and buffers	Chapters 2,4,5	PymoL Buffers and pH Acid-Base Solution Online Simulation pH scale simulation Eating & Exercise Online Lab: PhET
UNIT 2	**II. The Cell** Explain similarities, differences & evolutionary relationships between prokaryotic and eukaryotic cells Cell membrane structure and function (Fluid mosaic fluid) Subcellular organization Cell communication (signals, receptors, response, hormones) Methods of transport across membranes	Chapters 3,7,8 & 11	Diffusion & Osmosis **AP Lab 4** Membrane Channels Online Lab: PhET

UNIT 3	**III. Cell Energy & Metabolism** ATP structure and function Redox reactions in relation to cellular respiration Enzyme catalysis Activation energy and specificity Cellular respiration glycolysis, citric acid cycle,	Chapters 6,9,10	Photosynthesis **AP Lab 5** Cellular Respiration **AP Lab 6**

	electron transport chain & chemiosmosis Mitochondria form and function Photosynthesis mechanisms; light/dark Compare/contrast to respiration Alternative mechanisms Understanding light energy		
Heredity, Genetics & Evolution			
UNIT 4	**IV. Molecular Basis of Inheritance & Molecular Genetics** DNA structure and replication RNA structure Protein synthesis, transcription & translation Mutations-basis for natural selection Viral structure and replication Biotechnology and applications to society Regulation of gene expression Gene expression in bacteria	Chapters 16-21 Watson & Cricks original Science article	Stretching DNA simulation: PhET Gene Machine: The Lac Operon simulation Gel Electrophoresis Biotechnology: Bacterial Transformation **Lab 8** Biotechnology: Restriction Enzyme Analysis of DNA **Lab 9**
UNIT 5	**V. Mitosis & Meiosis** Cell Cycle Chromosomes Stages of meiosis Asexual vs. Sexual reproduction and evolutionary advantages Genetic variation in offspring and impact on evolution Investigating genetics: environmental influences	Chapters 12-13 & 46-47	Cell Division: Mitosis and Meiosis **Lab 7**

UNIT 6	**VI. Mendelian Genetics** Patterns of Inheritance Predicting genetic outcomes & genetic counseling Gene linking & mapping Mutations revisited	Chapters 14, 15	
UNIT 7	**VII. Evolutionary Biology** Darwin's explorations and theory of descent with modification & natural selection Galapagos Islands Overview Early evolution of life Evidence for evolution Phylogeny Evolution of populations Hardy-Weinberg Law	Chapters 22-25, 26 "Welcome to Evolution 101" Lamb, Trevor D., "Evolution of the Eye"	Natural Selection Online Simulation Artificial Selection **Lab 1** Mathematical Modeling: Hardy-Weinberg **Lab 2** BLAST **Lab 3**
Organisms & Populations			
UNIT 8	**VIII. Biological Diversity & Microbiology** Early life on earth Evolution of prokaryotes and eukaryotes Phylogenetic classification Evolutionary patterns Protists Fungi	Chapters 26-28, 31	Gram-Staining Culturing Bacteria
UNIT 9	**IX. Plants & their diversity** How plants colonized land Evolution of seed plants Structure, growth & development Plants responses to internal & external stimuli	Chapters 29, 30, 35-39	Transpiration **AP Lab 11**

	Plant nutrition Angiosperm reproduction		
UNIT 10	**X. Animal Diversity** Characteristics of Invertebrates & Vertebrates Analysis of structure & function of body systems Body systems Response to the environment Reproduction, growth, and development	Chapters 32-34, 40-49	Pig Dissection Hands-on and virtual simulation Anatomy Online Lab Bioweb.wku.edu Fruit Fly Behavior **AP Lab 12**
UNIT 11	**XI. Ecology & Interactions** Population dynamics Communities and ecosystems Global issues	Chapters 50-55	Energy Dynamics **AP Lab 10** Brine Shrimp and Toxicity

Unit Lengths:

Unit 1: Biochemistry:	1 week
Unit 2: The Cell:	2 weeks
Unit 3: Cell Energy and Metabolism:	3 weeks
Unit 4: Molecular Biology:	3 weeks
Unit 5: Mitosis and Meiosis:	1 week
Unit 6: Mendelian Genetics:	2 weeks
Unit 7: Evolutionary Biology:	3 weeks
Unit 8: Biological Diversity :	2 weeks
Unit 9: Plants and their Diversity:	3 weeks
Unit 10: Animal Diversity:	4 weeks
Unit 11: Ecology and Interactions:	2 weeks

IV. Unit Descriptions

Unit 1: Biochemistry

Enduring Understanding

1. The structure and function of chemical compounds directly relate to the structures and functions of the living organism.

Essential Question(s)

1. How are biological molecules necessary for organisms to grow, to reproduce, and to maintain organization?
2. How do the subcomponents of biological molecules determine the properties of that molecule?

Learning Objectives.

1. Justify the selection of data regarding the types of molecules that an animal, plant, or bacterium will take up as necessary building blocks and excrete as waste products.
2. Explain the connection between the sequence and the subcomponents of a biological polymer and its properties.
3. Construct explanations based on evidence of how variation in molecular units provides cells with a wider range of functions.
4. Represent graphically or model quantitatively the exchange of molecules between an organism and its environment, and the subsequent uses of these molecules to build new molecules that facilitate dynamic homeostasis, growth, and reproduction.
5. Refine representations and models to explain how the subcomponents of a biological polymer and their sequence determine the properties of that polymer.
6. Use models to predict and justify that changes in the subcomponents of a biological polymer affect the functionality of the molecule.
7. Analyze data to identify how molecular interactions affect structure and function.

Suggested Activities.

1. Water Investigation
2. Molecular Model building
3. Buffer/Liver Lab
4. online investigations
5. Reading guides
6. quizzes
7. Unit test

New Jersey Core Curriculum Content Standards.
5.1.12.A.1-3 5.3.12.A.1,6
5.1.12.B.1-4
5.1.12.C.1-3
5.1.12.D.1-3
5.2.12.A.1, 3, 4, 6
5.2.12.B.1, 2

Unit 2: The Cell

Enduring Understanding

1. Living systems at the level of the organism and at the cellular level have a complex nature through which structure relates to function.
2. All organisms transfer matter and convert energy from one form to another. Both are necessary to build and maintain organized structures within the organism.

Essential Question(s)

1. How do shared conserved cellular processes support the idea that all organisms are linked by lines of descent from common ancestry?
2. How do cells create and maintain internal environments that are different from their external environments?
3. How do structure and function of subcellular components and their interactions provide essential cellular processes?
4. How do cells maintain dynamic homeostasis by the movement of molecules across membranes?
5. How are external signals converted into cellular responses?

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Learning Objectives

1. Use calculated surface area-to-volume ratios to predict which cell(s) might eliminate wastes or procure nutrients faster by diffusion.
2. Explain how cell size and shape affect the overall rate of nutrient intake and the rate of waste elimination
3. Explain how internal membranes and organelles contribute to cell functions.
4. Use representations and models to describe differences in prokaryotic and eukaryotic cells.
5. Make a prediction about the interactions of subcellular organelles.
6. Construct explanations based on scientific evidence as to how interactions of subcellular structures provide essential functions.
7. Use representations and models to analyze situations qualitatively to describe how interactions of subcellular structures, which possess specialized functions, provide essential functions.
8. Use representations and models to pose scientific questions about the properties of cell membranes and selective permeability based on molecular structure
9. Construct models that connect the movement of molecules across membranes with membrane structure and function.
10. Use representations and models to analyze situations or solve problems qualitatively or quantitatively to investigate whether dynamic homeostasis is maintained by the active

movement of molecules across membranes
11. Describe basic chemical processes for cell communication shared across evolutionary lines of descent.
12. Generate scientific questions involving cell communication as it relates to the process of evolution.
13. Use representation(s) and appropriate models to describe features of a cell signaling pathway.
14. Construct explanations and representations of cell communication through cell-to-cell direct contact or through chemical signaling.
15. Describe a model that expresses the key elements of signal transduction pathways by which a signal is converted to a cellular response.
16. Justify claims based on scientific evidence that changes in signal transduction pathways can alter cellular response.
17. Construct an explanation of how certain drugs affect signal reception and, consequently, signal transduction pathways.

Suggested Activities

1. AP lab: Diffusion and Osmosis (mini poster)
2. Cell structure Gizmo
3. *Elodea* Quick Lab: salt concentrations
4.Cell communication diagrams
5. Reading guides
6. online investigations
7. quizzes
8. unit test

New Jersey Core Curriculum Content Standards

5.1.12.A.1-3
5.1.12.B.1-4
5.1.12.C.1-3
5.1.12.D.1-3
5.3.12.B.1-6
5.3.12.C.1-2
5.4.12.F.1-3
5.4.12.G.1-7

Unit 3: Cell Energy and Metabolism

Enduring Understanding

1. All organisms transfer matter and convert energy from one form to another. Both are necessary to build and maintain organized structures within the organism.
2. Homeostasis is essential for the survival of living things. Various environmental changes may affect homeostasis. The organism must respond to these changes in order to survive.

Essential Question(s)

1. How do biological systems utilize free energy to grow, to reproduce, and to maintain homeostasis?
2. How do organisms capture, use, and store free energy?

Learning Objectives

1. Explain how biological systems use free energy based on empirical data that all organisms require constant energy input to maintain organization, to grow, and to reproduce.
2. Justify a scientific claim that free energy is required for living systems to maintain organization, to grow, or to reproduce, but that multiple strategies exist in different living systems.
3. Predict how changes in free energy availability affect organisms, populations, and ecosystems.
4. Use representations and models to analyze how cooperative interactions within organisms promote efficiency in the use of energy and matter.
5. Use representations to pose scientific questions about what mechanisms and structural features allow organisms to capture, store, and use free energy.
6. Describe specific examples of conserved core biological processes and features shared by all domains or within one domain of life, and how these shared, conserved core processes and features support the concept of common ancestry for all organisms.

Suggested Activities

1. AP lab: Photosynthesis (Floating disk)
2. AP lab: Respiration (online biologyplace)
3. Cell signaling concept map
4. Paperase activity
5. AP lab: Enzymes (mini poster)
6. Reading guides
7. Quizzes

8. Unit test

New Jersey Core Curriculum Content Standards

5.1.12.A.1-3
5.1.12.B.1-4
5.1.12.C.1-3
5.1.12.D.1-3
5.3.12.B.1-6
5.3.12.C.1-2
5.4.12.F.1-3
5.4.12.G.1-7

Unit 4: Molecular Genetics

Enduring Understanding

1. Living systems at the level of the organism and at the cellular level have a complex nature through which structure relates to function
2. The structure of chemical compounds directly relate to the structures and functions of the living organism.

Essential Question(s)

1. How do living systems store, retrieve, and transmit genetic information critical to life processes?
2. How does the expression of genetic material control cell products which, in turn, determine the metabolism and nature of the cell?
3. How can humans use genetic engineering techniques to manipulate genetic information? What are ethical issues raised by the application of these techniques?

Learning Objectives

1. Justify the claim that humans can manipulate heritable information by identifying *at least two* commonly used technologies.
2. Construct scientific explanations that use the structures and mechanisms of DNA and RNA to support the claim that DNA and, in some cases, that RNA are the primary sources of heritable information.
3. Justify the selection of data from historical investigations that support the claim that DNA is the source of heritable information.
4. Describe representations and models that illustrate how genetic information is copied for transmission between generations.
5. Describe representations and models illustrating how genetic information is translated into polypeptides.
6. Predict how a change in a specific DNA or RNA sequence can result in changes in gene expression
7. Describe the connection between the regulation of gene expression and observed differences between individuals in a population.
8. Use representations to describe how gene regulation influences cell products and function.
9. Refine representations to illustrate how interactions between external stimuli and gene expression result in specialization of cells, tissues, and organs.
10. Justify a claim made about the effect(s) on a biological system at the molecular, physiological, or organismal level when given a scenario in which one or more components within a negative regulatory system is altered.

11. Explain how signal pathways mediate gene expression, including how this process can affect protein production
12. Connect concepts in and across domains to show that the timing and coordination of specific events are necessary for normal development in an organism and that these events are regulated by multiple mechanisms.
13. Use a graph or diagram to analyze situations or solve problems (quantitatively or qualitatively) that involve timing and coordination of events necessary for normal development in an organism
14. Describe the role of programmed cell death in development and differentiation, the reuse of molecules, and the maintenance of dynamic homeostasis.
15. Predict how a change in genotype, when expressed as a phenotype, provides a variation that can be subject to natural selection.
16. Predict the effects of a change in an environmental factor on the genotypic expression of the phenotype.

Suggested Activities

1. AP Lab: Bacterial transformation
2. AP Lab: Restriction enzyme analysis of DNA
3. Gel electrophoresis activity
4. Online molecular biology activities
5. Reading guides
6. Quizzes
7. Unit test

New Jersey Core Curriculum Content Standards

5.1.12.A.1-3
5.1.12.B.1-4
5.1.12.C.1-3
5.1.12.D.1-3
5.3.12.A.2-6
5.3.12.D.1-3
5.3.12.E.1

Unit 5: Mitosis and Meiosis

Enduring Understanding

1. Predictable patterns of inheritance, and the variation that exists within a species is related to its mode of reproduction.

Essential Question(s)

1. How do living systems transmit genetic information critical to life processes?
2. How does the transmission of genetic material control cell products which, in turn, determine the metabolism and nature of the cell?

Learning Objectives

1. Make predictions about natural phenomena occurring during the cell cycle.
2. Describe the events that occur in the cell cycle.
3. Construct an explanation, using visual representations or narratives, as to how DNA in chromosomes is transmitted to the next generation via mitosis, or meiosis followed by fertilization.
4. Represent the connection between meiosis and increased genetic diversity necessary for evolution.
5. Evaluate evidence provided by data sets to support the claim that heritable information is passed from one generation to another through mitosis, or meiosis followed by fertilization.

Suggested Activities

1. AP Lab: Mitosis and Meiosis
2. Online mitosis/meiosis practice
3. Reading guide
4. Quiz

New Jersey Core Curriculum Content Standards

5.1.12.A.1-3
5.1.12.B.1-4
5.1.12.C.1-3
5.1.12.D.1-3
5.3.12.A.2-6
5.3.12.D.1-3
5.3.12.E.1

Unit 6: Mendelian Genetics

Enduring Understanding
1. Heritable information provides for continuity of life
2. Expression of genetic information involves cellular and molecular mechanisms
3. The processing of genetic information is imperfect and is a source of genetic variation.

Essential Question(s)
1. How do living systems store, retrieve, and transmit genetic information critical to life processes?
2. How does the expression of genetic material control cell products which, in turn, determine the metabolism and nature of the cell?
3. What is the relationship between changes in genotype and phenotype and evolution?

Learning Objectives
1. Construct a representation that connects the process of meiosis to the passage of traits from parent to offspring.
2. Pose questions about the ethical, social, or medical issues surrounding human genetic disorders.
3. Apply mathematical routines to determine Mendelian patterns of inheritance provided by data sets.
4. Explain deviations from Mendel's model of the inheritance of traits.
5. Explain how the inheritance patterns of many traits cannot be accounted for by Mendelian genetics.
6. Describe representations of an appropriate example of inheritance patterns that cannot be explained by Mendel's model of the inheritance of traits.
7. Construct explanations of the influence of environmental factors on the phenotype of an organism.
8. Use evidence to justify a claim that a variety of phenotypic responses to a single environmental factor can result from different genotypes within the population.

Suggested Activities
1. Linked chromosome activity (cats)
2. Genetics practice problem sets
3. AP Lab: online *Drosophila* chi square lab
4. Chi square practice problem sets
5. Reading guides
6. Quizzes

7. Unit test

New Jersey Core Curriculum Content Standards

5.1.12.A.1-3
5.1.12.B.1-4
5.1.12.C.1-3
5.1.12.D.1-3
5.3.12.A.2-6
5.3.12.D.1-3
5.3.12.E.1

Unit 7: Evolutionary Biology

Enduring Understanding

1. Change in the genetic makeup of a population over time is evolution
2. Organisms are linked by lines of descent from common ancestory
3. Life continues to evolve within a changing environment
4. The origin of living systems is explained by natural processes

Essential Question(s)

1. How does evolution by natural selection drive the diversity and unity of life?
2. What scientific evidence from many disciplines, including mathematics, supports models about the origin of life on Earth and biological evolution?
3. How can phylogenetic trees and cladograms be used to graphically model evolutionary history among species?

Learning Objectives

1. Convert a data set from a table of numbers that reflect a change in the genetic makeup of a population over time and apply mathematical methods and conceptual understandings to investigate the cause(s) and effect(s) of this change.
2. Evaluate evidence provided by data to qualitatively and quantitatively investigate the role of natural selection in evolution.
3. Evaluate data-based evidence that describes evolutionary changes in the genetic makeup of a population over time.
4. Connect evolutionary changes in a population over time to a change in the environment.
5. Use data from mathematical models based on the Hardy-Weinberg equilibrium to analyze genetic drift and effects of selection in the evolution of specific populations.
6. Make predictions about the effects of genetic drift, migration, natural and artificial selection on the genetic makeup of a population.
7. Evaluate evidence provided by data from many scientific disciplines to support biological evolution.
8. Design a plan to answer scientific questions regarding how organisms have changed over time using information from morphology, biochemistry, and geology.
9. Connect scientific evidence from many scientific disciplines to support the modern concept of evolution.
10. Pose scientific questions about a group of organisms whose relatedness is described by a phylogenetic tree or cladogram in order to (1) identify shared characteristics, (2) make inferences about the evolutionary history of the group, and (3) identify character data that

could extend or improve the phylogenetic tree.
11. Construct explanations based on scientific evidence that homeostatic mechanisms reflect continuity due to common ancestry and/or divergence due to adaptation in different environments.
12. Design a plan for collecting data to investigate the scientific claim that speciation and extinction have occurred throughout the Earth's history.
13. Use data from a real or simulated population(s), based on graphs or models of types of selection, to predict what will happen to the population in the future.
14. Describe speciation in an isolated population and connect it to change in gene frequency, change in environment, natural selection, and/or genetic drift.
15. Justify the selection of data that addresses questions related to reproductive isolation and speciation.
16. Evaluate given data sets that illustrate evolution as an ongoing process.
17. Describe a scientific hypothesis about the origin of life on Earth.
18. Describe the reasons for revisions of scientific hypotheses about the origin of life on Earth.
19. Evaluate the accuracy and legitimacy of data to answer scientific questions about the origin of life on Earth.
20. Justify the selection of geological, physical, and chemical data that reveal early Earth conditions.

Suggested Activities
1. AP Lab: Artificial selection
2. AP Lab: Hardy-Weinberg
3. AP Lab: BLAST
4. Evolution concept map
5. Reading guides
6. Quizzes
7. Unit test

New Jersey Core Curriculum Content Standards
5.1.12.A.1-3
5.1.12.B.1-4
5.1.12.C.1-3
5.1.12.D.1-3
5.3.12.E.1-4
5.4.12.B.1-3

Unit 8: Biological Diversity

Enduring Understanding
1. Organisms are linked by lines of descent from common ancestry
2. Organisms share many conserved core processes and features that evolved and are widely distributed among organisms today.

Essential Question(s)
1. How is evolution related to classification of organisms?
2. Why is it important to classify organisms?
3. What common traits do prokaryotes and eukaryotes share? Protists and fungi?

Learning Objectives
1. List, describe and compare the levels of organization (ie: Biome, Ecosystem, Etc.)
2. Describe how organisms are classified and the use of binomial nomenclature.^^
3. Distinguish different types of bacteria based on shape and habitat.
4. Outline basic characteristics of protists, fungi, plants and animals.

Suggested Activities
1. Culturing bacteria activity
2. Protist Comparison activity
3. Reading guides
4. Quizzes
5. Unit test

New Jersey Core Curriculum Content Standards
5.1.12.D.1
5.3.12.A.6
5.3.12.E.3

Unit 9: Plants and their diversity

Enduring Understanding

1. Growth and homeostasis of a biological system influenced by the system's internal and external environment
2. Interactions within biological systems lead to complex properties

Essential Question(s)

1. How are positive and negative feedback mechanisms used in organisms to maintain homeostasis?
2. How can disruptions to homeostasis in biological systems be analyzed?

Learning Objectives

1. Connect how organisms use negative feedback to maintain their internal environments.
2. Justify that positive feedback mechanisms amplify responses in organisms.
3. Justify the selection of the kind of data needed to answer scientific questions about the relevant mechanism that organisms use to respond to changes in their external environment.
4. Design a plan for collecting data to support the scientific claim that the timing and coordination of physiological events involve regulation.
5. Use representations or models to analyze quantitatively and qualitatively the effects of disruptions to dynamic homeostasis in biological systems.
6. Analyze data to identify phylogenetic patterns or relationships, showing that homeostatic mechanisms reflect both continuity due to common ancestry and change due to evolution in different environments.
7. Connect differences in the environment with the evolution of homeostatic mechanisms.

Suggested Activities

1. AP Lab: Transpiration
2. Vodcasts on plant structure/function
3. Reading guides
4. Quizzes
5. Unit test

New Jersey Core Curriculum Content Standards

5.1.12.A.1-3
5.1.12.B.1-4
5.1.12.C.1-3
5.1.12.D.1-3
5.3.12.E.1-4
5.4.12.B.1-3

Unit 10: Animal Diversity

Enduring Understanding
1. Organisms are linked by lines of descent from common ancestry
2. Growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment

Essential Question(s)
1. How are growth and homeostasis of a biological system influenced by the system's environment?

Learning Objectives
1. Create representations and models to describe immune responses
2. Create representations or models to describe nonspecific immune defenses in plants and animals.
3. Construct an explanation, based on scientific theories and models, about how nervous systems detect external and internal signals, transmit and integrate information, and produce responses.
4. Describe how nervous systems detect external and internal signals.
5. Describe how nervous systems transmit information.
6. Describe how the vertebrate brain integrates information to produce a response.
7. Create a visual representation to describe how nervous systems detect external and internal signals.

Suggested Activities
1. AP Lab: Animal behavior
2. Anatomy online lab: bioweb.wku.edu
3. Presentations
4. Reading guides
5. Quizzes
6. Unit test

New Jersey Core Curriculum Content Standards

5.1.12.A.1-3
5.1.12.B.1-4
5.1.12.C.1-3
5.1.12.D.1-3
5.3.12.A.2-6
5.3.12.D.1-3
5.3.12.E.1

Unit 11: Ecology and Interactions

Enduring Understanding

1. All organisms transfer matter and convert energy from one form to another. Both are necessary to build and maintain organized structures within the organism.
2. This organization expands beyond the organism to the ecosystem. Any change in this organization can affect other organisms which depend on each other.
3. The survival of organisms is affected by interactions with each other and their environment. It can be altered by human manipulation

Essential Question(s)

1. How do interactions among living systems and with their environment result in the movement of matter and energy?
2. How do interactions between and within populations influence patterns of species distribution and abundance?
3. How does human activity affect the biodiversity of ecosystems?

Learning Objectives

1. Explain how the distribution of ecosystems changes over time by identifying large-scale events that have resulted in these changes in the past.
2. Refine scientific models and questions about the effect of complex biotic and abiotic interactions on all biological systems, from cells and organisms to populations, communities, and ecosystems
3. Design a plan for collecting data to show that all biological systems (cells, organisms, populations, communities, and ecosystems) are affected by complex biotic and abiotic interactions.
4. Analyze data to identify possible patterns and relationships between a biotic or abiotic factor and a biological system (cells, organisms, populations, communities, or ecosystems).
5. Predict the effects of a change in a component(s) of a biological system on the functionality of an organism(s).
6. Justify the selection of the kind of data needed to answer scientific questions about the interaction of populations within communities.
7. Apply mathematical routines to quantities that describe communities composed of populations of organisms that interact in complex ways.
8. Predict the effects of a change in the community's populations on the community.
9. Predict the effects of a change of matter or energy availability on communities.
10. Use data analysis to refine observations and measurements regarding the effect of

population interactions on patterns of species distribution and abundance.
11. Predict consequences of human actions on both local and global ecosystems.

Suggested Activities
1. AP Lab: Energy Dynamics
2. Brine Shrimp and Toxicity Lab
3. Reading guides
4. Quizzes
5. Unit test

Suggested Activities & Suggested Modifications for Special Education Students, ELL Students, Students at Risk, and Gifted Students:

1. Students with special needs and ELL learners may be provided with key vocabulary terms prior to the unit beginning. In particular, the amount of key vocabulary terms should be reduced for ELL students.
2. ELL students may be provided with additional visual aids. For additional modifications, refer to Classroom Instruction that Works for ELL Learners *or the* SIOP protocol.
3. Gifted students may be challenged by asking them to form additional connections between biology, chemistry, and physics.

New Jersey Core Curriculum Content Standards

5.1.12.A.1-3
5.1.12.B.1-4
5.1.12.C.1-3
5.1.12.D.1-3
5.3.12.B.1-6
5.3.12.C.1-2
5.4.12.F.1-3
5.4.12.G.1-1

V. Course Materials

1. Text: Campbell Biology
2. Teacher Textbook supplementary materials
3. Videos/United Streaming
4. Laboratory supplies and equipment
5. Computer simulations, book websites, and reinforcement applications
6. Technology: Computers, Videoscope, SmartBoard, PowerPoint program

The following websites from the NJDOE are available for science curriculum reference.
http://www.nj.gov/education/aps/cccs/science/http://www.njcccs.org

VI. Assessments

Each unit will have a variety of tests, quizzes, labs, projects, written homework assignments, presentations and class activities. These assessments will be geared toward the main learning objectives for each unit. In addition there will be a Midterm exam and Final project. There will be no Final exam as all students are required to take the AP biology exam.

VII. Cross Curricular Aspects

Biology teachers will work with Algebra 1 teachers to enhance student understanding of graphing, equation calculations, and basic statistical analysis.

CCCS Literacy: Click on the link to the High School Evidence Statements to see expectations related to literacy for this unit. In addition, a focus of the course will be on the development of the LAL standards for science & technical subjects.

CCCS Math: Students will be expected to perform measurement, modeling, apply algebra, and geometry and statistics.

Interdisciplinary Connections and Alignment to Technology standards

Science classes in the Fair Lawn Public schools promote career-readiness skills related to Personal Financial Literacy (9.1) and Career Awareness, Exploration, and Presentation (9.2). Some course concepts from the Career and Technical Education Standards (9.3), but these are not directly correlated since our district is not a CTE program.

The Fair Lawn Public Schools District fosters an environment that promotes career-readiness skills in all content areas. Whereas Career Ready Practices are explored consistently, specific alignment to Personal Finance Literacy (9.1) and Career Awareness, Exploration, and Presentation Standards (9.2) are included in the district level document (below). When appropriate, the Career and Technical Education Standards (9.3) have been reviewed and aligned as well.

Examples: 9.2B: Career exploration in each unit of study.

In addition, every effort is made to integrate technology and engineering into our science classes. Educational Technology (8.1) and Technology Education, Engineering, Design, and Computational Thinking – Programming (8.2) standards are cross connected throughout our science programs.

Examples:
- 8.1A: Use spreadsheets to analyze & interpret data from laboratories, 6-12.
  Use the internet to increase productivity and efficiency, 9-12.
- 8.1B,C: Use data to solve real-world problems, 6-12.
  Use online platforms to collaborate & address global issues, 9-12.
- 8.1F: Collect and analyze data using internet and data simulations, 6-12.
- 8.2A: Become aware of the invention process, 3-5.
- 8.2B: Become aware of the global impacts on technology, 6-12.

8.2C: Apply the design process to pushes & pulls, K-2.
8.2D: Use tools to reduce work, K-2.

For additional detail on how these standards are integrated throughout the Fair Lawn Schools curriculum, review the Fair Lawn Public Schools District Alignment to Technology & Career Readiness & 21st Century Skills Standards Curriculum Appendix.