CURRICULUM MANAGEMENT SYSTEM

MONROE TOWNSHIP SCHOOLS

Course Name: Advanced Placement Biology
Grade: 11-12

For adoption by all regular education programs as specified and for adoption or adaptation by all Special Education Programs in accordance with Board of Education Policy # 2220.

Board Approved: October 2011

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MONROE TOWNSHIP SCHOOL DISTRICT

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ACKNOWLEDGEMENTS

The following individuals are acknowledged for their assistance in the preparation of this Curriculum Management System:

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VISION, MISSION, AND GOALS

Vision Statement

The Monroe Township Board of Education commits itself to all children by preparing them to reach their full potential and to function in a global society through a preeminent education.

Mission Statement

The Monroe Public Schools in collaboration with the members of the community shall ensure that all children receive an exemplary education by well trained committed staff in a safe and orderly environment.

Goals

Raise achievement for all students paying particular attention to disparities between subgroups.

Systematically collect, analyze, and evaluate available data to inform all decisions.

Improve business efficiencies where possible to reduce overall operating costs.

Provide support programs for students across the continuum of academic achievement with an emphasis on those who are in the middle.

Provide early interventions for all students who are at risk of not reaching their full potential.

PHILOSOPHY

The Monroe Township High School STEM Academy (Science, Technology, Engineering and Mathematics) is predicated on research that supports the creation of a rich, student-centered, inquiry-based, innovative learning community. Our STEM philosophy endeavors to incorporate a challenging, multi-disciplinary-integrated curriculum model that is infused with a variety of real-world applications for global problem solving. With the clear integration of the sciences, technology, engineering and mathematics students can navigate through an interconnected framework of courses designed to expand conceptual understanding, promote critical thinking, and enhance scientific literacy to support research and discovery. Our overarching goal is to foster a rigorous academic environment that is highly engaging, collaborative and challenges each individual learner to become fully college and career ready for work in our global society.

EDUCATIONAL GOALS

The main goals of AP Biology are to help students gain an appreciation of science as a process as well as being the equivalent of a college introductory biology course usually taken by Biology majors during their first year. Due to the many advances in technology, Biology is an every changing subject matter. The primary emphasis in this course is to give students an overall understanding of larger Biological concepts rather than a narrow view of terms and processes that need to be memorized. Essential to this conceptual understanding of Biology is a grasp of science as a process rather than as an accumulation of facts. This conceptual understanding can be achieved through scientific inquiry and critical thinking assessments rather than rote memory skills. The goal of this course is to provide students with the knowledge of college level Biology by giving them the skills they need to conceptualize Biology rather than memorize Biology.

NJDOE: CORE CURRICULUM CONTENT STANDARDS

A note about Common Core State Standards for Science

The Common Core State Standards for Science were adopted by the state of New Jersey in 2009. The standards referenced in this curriculum guide refer to these new standards and may be found in the Curriculum folder on the district servers. A complete copy of the new Common Core State Standards for Science may also be found at:

Common Core: http://www.corestandards.org/the-standards

2009 NJ State Standards: http://www.state.nj.us/education/cccs/standards/5/index.html

College Board AP Biology Curriculum Framework 2012 – 2013 can be found at:
http://media.collegeboard.com/digitalServices/pdf/ap/10b_2727_AP_Biology_CF_WEB_110128.pdf

Quarter I

Big Idea I: Systems	Big Idea II: Relationships
Cells and Molecules A. Themes of biology/Characteristics of life B. Atomic models and chemical bonds C. Emergent properties of water, pH and solutions D. Organic chemistry and macromolecules E. Cells and organelles	**Transport of Materials** A. Fluid mosaic model B. Mechanisms of cellular transport C. Water and organic nutrient transport in plants D. Osmoregulation and excretion in animals E. Circulation and gas exchange in animals

Quarter I

Big Idea III: Change

Energy Capture, Transformation and Release

A. Metabolism and RedOx reactions
B. Cellular respiration – Energy release
C. Animal nutrition and digestion
D. Photosynthesis – Energy capture
E. Plant nutrition

Quarter II

Quarter II

Big Idea IV: Structure/Function

Interaction with the External Environment

A. Cell communication
B. Plant hormones and responses to the environment
C. Animal hormones and endocrine system
D. Nervous, sensory and motor systems
E. Immune system

Big Idea V: Change

Growth and Development

A. Cell cycle and mitosis
B. Plant structure, growth and development
C. Animal form and function

Reproduction and Genetics

A. Meiosis
B. Animal reproduction
C. Plant reproduction
D. Animal development
E. Mendelian genetics and inheritance patterns
F. Molecular basis of inheritance
G. Biotechnology

Quarter III

Big Idea VI: Behavior

Evolution and Diversity

A. Mechanisms of evolution
B. Population genetics (microevolution)
C. Speciation (macroevolution)
D. Bacteria/Archaea diversity
E. Protist diversity
F. Fungus diversity
G. Plant diversity
H. Animal diversity

Quarter II
Quarter IV

Big Idea VII: Systems

Ecology

A. Behavioral ecology
B. Population ecology
C. Community ecology
D. Ecosystems

BIG IDEA I: Systems

Curriculum Management System
COURSE NAME: AP Biology

OVERARCHING GOALS

1. All students will understand that science is both a body of knowledge and evidence-based, model-building enterprise that continually extends, refines, and revises knowledge.
2. Investigate, research, and synthesize data and information to understand meaningful real-world problems.

ESSENTIAL QUESTIONS

- How do we know if something is alive or not?
- How does the structure of organic molecules reflect and dictate their function in the cell?
- How does the structure of a cell reflect its function in the organism?
- How do the unique physical and chemical properties of water make life on Earth possible?
- How does compartmentalization organize a cell's functions?

SUGGESTED BLOCKS FOR INSTRUCTION: 15

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
• Biological molecules are composed of smaller subunits called monomers • Structure and function of polymers are derived from the way their monomers are assembled. (5.3.12.A.1; 5.3.12.A.2)	• Life requires a highly ordered system. • Living systems depend on properties of water that result from its polarity and hydrogen bonding. • Alterations in the mechanisms of feedback often result in deleterious consequences. • Changes in the structure of a molecular system may result in a change of the function of the system. • The change in function of an enzyme can be interpreted from data regarding the concentrations of product or substrate as a function of time. **Sample Conceptual Understandings** During an investigation of a freshwater lake, an AP Biology student discovers a previously unknown microscopic organism. Further study shows that the unicellular organism is eukaryotic. (a) **Identify** FOUR organelles that should be present in the eukaryotic organism and **describe** the function of each organelle. (b) Prokaryotic cells lack membrane-bound organelles found in eukaryotes. However, prokaryotes must perform many of the same functions as eukaryotes. For THREE of the organelles identified in part (a), **explain** how prokaryotic cells carry out the associated functions. (c) According to the endosymbiotic theory, some organelles are believed to have evolved through a symbiotic relationship between eukaryotic and prokaryotic cells. **Describe** THREE observations that support the endosymbiotic theory.	• Explain the connection between the sequence and subcomponents of a biological polymer and its properties • Use models to justify the claim that changes in the subcomponents of a biological polymer affect the functionality of the molecule. • Explain how internal membranes and organelles contribute to cell functions. • Use representations and models to describe differences in prokaryotic and eukaryotic cells. • Make predictions about how organisms use negative feedback to maintain their internal environment. • Evaluate data that show the effect(s) of changes in concentrations of key molecules on negative feedback mechanisms. • Make predictions about how positive feedback
• Internal membranes facilitate cellular processes by minimizing competing interactions and by increasing surface area where reactions can occur. • Membranes and membrane-bound organelles in eukaryotic cells localize intracellular metabolic processes and specific enzymatic reactions. • Archaea and bacteria generally lack internal membranes and organelles and have a cell wall. (5.3.12.A.3)		

	• Negative feedback mechanisms maintain dynamic homeostasis for a particular condition by regulating physiological processes, returning the changing condition back to its set point. • Positive feedback mechanisms amplify responses and processes in biological systems. (5.3.12.A.3)	2. An experiment was conducted to measure the reaction rate of the human salivary enzyme α-amylase. Ten mL of a concentrated starch solution and 1.0 mL of α-amylase solution were placed in a test tube. The test tube was inverted several times to mix the solution and then incubated at 25°C. The amount of product (maltose) present was measured every 10 minutes for an hour. The results are given in the table below. **Time (minutes)** / **Maltose Concentration (μM)** 0 / 0 10 / 5.1 20 / 8.6 30 / 10.4 40 / 11.1 50 / 11.2 60 / 11.5 (a) **Graph** the data on the axes provided and **calculate** the rate of the reaction for the time period 0 to 30 minutes. (b) **Explain** why a change in the reaction rate was observed after 30 minutes. (c) **Draw** and **label** another line on the graph to predict the results if the concentration of α-amylase was doubled. **Explain** your predicted results. (d) **Identify** TWO environmental factors that can change the rate of an enzyme-mediated reaction. **Discuss** how each of those two factors would affect the reaction rate of an enzyme.	mechanisms amplify activities and processes based on scientific theories and models. • Analyze data to identify how molecular interactions affect structure and function.
	• Ribosomes are small, universal structures comprised of two interacting parts. • Endoplasmic reticulum occurs in two forms: smooth and rough. • The Golgi apparatus is a membrane-bound structure that consists of a series of flattened membrane sacs. • Mitochondria specialize in energy transformation. • Lysosomes carry out intracellular digestion in a variety of ways. • A vacuole is a membrane-bound sac that plays roles in intracellular digestion and the release of		

	cellular waste products. • Chloroplasts are specialized organelles that capture energy through photosynthesis. (5.3.12.A.1; 5.3.12.A.2; 5.3.12.A.3, 5.3.12.A.6)		
	• The shape of enzymes, active sites, and interaction with specific molecules are essential for basic functioning of the enzyme. • Other molecules and the environment in which the enzyme acts can enhance or inhibit enzyme activity. (5.3.12.A.2)		

21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		
Learning Activities		
Diffusion/Osmosis Lab (AP Lab #1) Enzyme Catalysis Lab (AP Lab #2)		
Performance Assessment Task Sample		

Assessment Models

- **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).**
- **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.**

Open-Ended Assessment:

- Sample AP Assessments

Open-Ended (Formative) Assessment:

- Differentiated group and individual work is assigned daily, from various sources *(Synthesis, Analysis, and Evaluation).*
- Introductory and Closing Activities will be done every day to pre-assess student knowledge and assess understanding of topics *(Synthesis, Analysis, and Evaluation).*
- Laboratory activities to reinforce and assess application of concepts and skills.

Summative Assessment:

- Assessment questions will be open-ended and should follow the general format illustrated in the Essential Questions/Sample Conceptual Understanding section. *(Synthesis, Analysis, Evaluation)*
- Assessment strategies will address a diverse array of learning modalities.
- Students will be given quizzes that provide a brief review of the concepts and skills in the previous lessons.
- Students will demonstrate understanding to assess to review skills and concepts in this unit.
- Students will record laboratory data in formal lab reports when assigned and with the use of iPad2 technology.

Additional Resources

BIG IDEA II: Relationships

Curriculum Management System
COURSE NAME: AP Biology

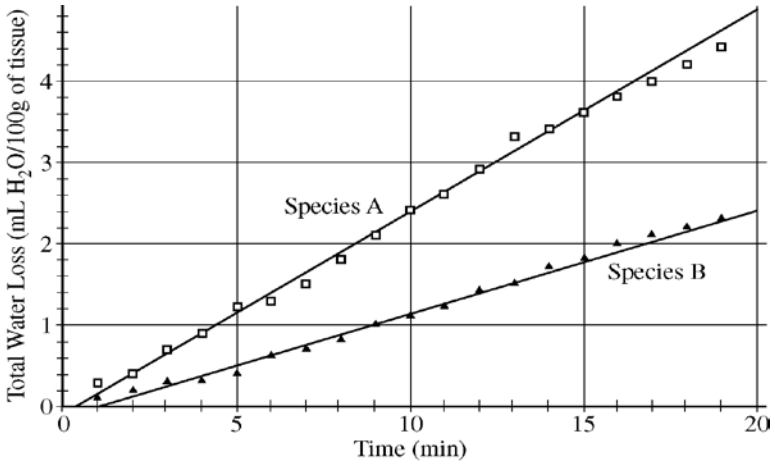
OVERARCHING GOALS

1. All students will understand that science is both a body of knowledge and evidence-based, model-building enterprise that continually extends, refines, and revises knowledge.
2. Investigate, research, and synthesize data and information to understand meaningful real-world problems.

ESSENTIAL QUESTIONS

- How does the structure of membranes relate to their functions?
- How do animal circulatory systems reflect phylogeny?

SUGGESTED BLOCKS FOR INSTRUCTION: 10

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
• Molecules and atoms from the environment are necessary to build new molecules. (5.3.12.A.1; 5.3.12.A.2; 5.3.12.A.3)	• Selective permeability is a direct consequence of membrane structure, as described by the fluid mosaic model. • Cell activities are affected by interactions with biotic and abiotic factors.	• Use calculated surface area-to-volume ratios to predict which cell(s) might eliminate wastes or obtain nutrients faster by diffusion. • Explain how cell size and shape affect the overall rate of nutrient intake and the rate of waste elimination.
• Surface area-to-volume ratios affect a biological system's ability to obtain necessary resources or eliminate waste products. (5.3.12.A.3; 5.3.12.A.6)	**Sample Conceptual Understanding** The regulation of transpiration is an important homeostatic mechanism in plants. (a) Under controlled conditions, a transpiration experiment was conducted using two plant species. The data collected are shown in the figure below. Using the data from the experiment, **calculate** the rate of transpiration for species A and species B between the times of 5 and 15 minutes (show your work). **Summarize** the difference between the two transpiration rates. WATER LOSS VERSUS TIME FOR TWO PLANT SPECIES  (b) **Identify** and **explain** THREE different structural or physiological adaptations that could account for the different transpiration rates of species A and B. (c) Water potential (Ψ) is described by the following formulas. $\Psi = \Psi_p + \Psi_s$ $\Psi = -iCRT$ **Discuss** the variables in both formulas and how they affect water potential.	
• Cell membranes separate the internal environment of the cell from the external environment. • Cell walls provide a structural boundary, as well as a permeability barrier for some substances to the internal environment. (5.3.12.A.6)		
• Passive transport does not require the		

KNOW		UNDERSTAND	DO
Students will know that:		***Students will understand that:***	***Students will be able to:***
	input of metabolic energy; the net movement of molecules is from high concentration to low concentration. • Active transport requires free energy to move molecules from regions of low concentration to regions of high concentration. (5.3.12.A.3; 5.3.12.A.6)		
	• The processes of endocytosis and exocytosis move large molecules from the external to the internal environment, and vice versa, respectively. • Organisms have various mechanisms for obtaining nutrients and eliminating wastes. (5.3.12.A.3; 5.3.12.A.6)		

BIG IDEA II: Relationships

KNOW		UNDERSTAND	DO
Students will know that:		***Students will understand that:***	***Students will be able to:***

21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		
Learning Activities		
Transpiration Lab (AP #9) Circulatory Physiology Lab (AP Lab #10)		
Performance Assessment Task Sample		

Assessment Models

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Open-Ended Assessment:

- Sample AP Assessments

Open-Ended (Formative) Assessment:

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Additional Resources

BIG IDEA III: Change

Curriculum Management System
COURSE NAME: AP Biology

OVERARCHING GOALS

1. All students will understand that science is both a body of knowledge and evidence-based, model-building enterprise that continually extends, refines, and revises knowledge.
2. Investigate, research, and synthesize data and information to understand meaningful real-world problems.

ESSENTIAL QUESTIONS

- Why do organisms need to transform energy into different forms?
- Why do organisms eat?

SUGGESTED BLOCKS FOR INSTRUCTION: 25

<table>
<tr><th colspan="2">KNOW</th><th>UNDERSTAND</th><th>DO</th></tr>
<tr><td colspan="2">Students will know that:</td><td>Students will understand that:</td><td>Students will be able to:</td></tr>
<tr><td></td><td>• Metabolic pathways are conserved across all currently recognized domains.
• Energy-related pathways are sequential and may be entered at multiple points in the pathway. (5.3.12.B.5; 5.3.12.B.6)</td><td rowspan="8">• Living systems do not violate the second law of thermodynamics.
• Order is maintained by coupling cellular processes that increase entropy with those that decrease entropy.
• Organisms use various strategies to regulate body temperature and metabolism.
• There is a relationship between metabolic rate per unit body mass and the size of multicellular organisms – generally, the smaller the organism the higher the metabolic rate.
• Different energy-capturing processes use different types of electron acceptors.
• Photosynthesis first evolved in prokaryotic organisms.

Sample Conceptual Understanding

Organisms utilize a diversity of methods to obtain proper nutrition.
a. Some organisms digest food intracellularly, while others digest food extracellularly.
• Identify ONE nonvertebrate organism that digests food intracellularly and describe the process.
• Identify ONE nonvertebrate organism that digests food extracellularly and describe the process.
b. Describe TWO structural features of the human stomach and/or small intestine. For each, explain how the structure relates to the function.
c. Plants have a variety of mechanisms for obtaining nutrients. Describe TWO plant structures and explain how each structure is utilized in nutrient uptake.</td><td rowspan="2">• Explain how biological systems use free energy based on empirical data.
• Justify the scientific claim that different strategies exist for living systems to use free energy.
• Use representations to pose scientific questions about what mechanisms and structural features allow organisms to capture, store and use free energy.
• Construct explanations of the mechanisms and structural features of cells that allow organisms to capture, store or use free energy.</td></tr>
<tr><td></td><td>• Energetically favorable exergonic reactions, such as ATP → ADP, can be used to maintain or increase order in a system. (5.3.12.B.2)</td></tr>
<tr><td></td><td>• Organisms use free energy to maintain organization, grow and reproduce.
• Organisms have areas or components that perform a subset of functions related to energy and matter, and these parts contribute to the whole. (5.3.12.B.1; 5.3.12.B.2)</td></tr>
<tr><td></td><td rowspan="3">• Excess acquired free energy versus required free energy expenditure results in energy storage or growth.
• Insufficient acquired free energy versus required free energy expenditure results in loss of mass and death of an organism. (5.3.12.B.2)</td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td>• Photosynthetic organisms capture free energy present in sunlight. (5.3.12.B.3;</td><td></td><td></td></tr>
</table>

KNOW		UNDERSTAND	DO
Students will know that:		***Students will understand that:***	***Students will be able to:***
	5.3.12.B.4)		
	• Chemosynthetic organisms capture free energy from small inorganic molecules present in their environment. • Chemosynthesis can occur in the absence of oxygen. (5.3.12.B.1; 5.3.12.B.6)		
	• Heterotrophs may metabolize carbohydrates, lipids, and proteins by hydrolysis. (5.3.12.B.6)		
	• Fermentation produces organic molecules, including alcohol and lactic acid, and occurs in the absence of oxygen. (5.3.12.B.6)		
	• The light-dependent reactions of photosynthesis in eukaryotes involve a series of coordinated reaction pathways that capture free energy present in light to yield ATP and NADPH. (5.3.12.B.3; 5.3.12.B.4)		
	• Cellular respiration in eukaryotes involves a series of coordinated enzyme-catalyzed reactions that harvest free energy from simple carbohydrates. • The electron transport chain captures free energy from		

KNOW		UNDERSTAND	DO
Students will know that:		***Students will understand that:***	***Students will be able to:***
	electrons in a series of coupled reactions that establish an electrochemical gradient across membranes. • Free energy becomes available for metabolism by the conversion of ATP → ADP, which is coupled to many steps in metabolic pathways. (5.3.12.B.6)		

21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		
Learning Activities		
Photosynthesis Lab (AP #4) Cell Respiration Lab (AP #5)		
Performance Assessment Task Sample		

Assessment Models

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Additional Resources

BIG IDEA IV: Structure/Function

Curriculum Management System
COURSE NAME: AP Biology

OVERARCHING GOALS

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2. Investigate, research, and synthesize data and information to understand meaningful real-world problems.

ESSENTIAL QUESTIONS

- How does the structure of a specific cell dictate its role in the organism?
- How does the structure of a cell dictate its interaction with the environment?

SUGGESTED BLOCKS FOR INSTRUCTION: 20

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
• Organisms respond to changes in their environment through behavioral and physiological mechanisms. • Continuity of homeostatic mechanisms reflects common ancestry, while changes may occur in response to different environmental conditions. (5.3.12.A.3)	• Homeostatic control systems in species of microbes, plants, and animals support common ancestry. • Correct and appropriate signal transduction processes are generally under strong selective pressure. **Sample Conceptual Understanding** Homeostatic maintenance of optimal blood glucose levels has been intensively studied in vertebrate organisms. (a) Pancreatic hormones regulate blood glucose levels. **Identify** TWO pancreatic hormones and **describe** the effect of each hormone on blood glucose levels. (b) For ONE of the hormones you identified in (a), **identify** ONE target cell and **discuss** the mechanism by which the hormone can alter activity in that target cell. **Include** in your discussion a description of reception, cellular transduction, and response. (c) **Compare** the cell-signaling mechanisms of steroid hormones and protein hormones.	• Connect differences in the environment with the evolution of homeostatic mechanisms. • Create models and representations to describe immune responses. • Describe basic chemical processes for cell communication shared across evolutionary lines of descent. • Use representations and models to describe features of a cell signaling pathway. • Create models that depict how cell-to-cell communication occurs by direct contact or from a distance through chemical signaling. • Construct an explanation about how nervous systems detect external and internal signals, transmit and integrate information and produce responses.
• Disruptions at the molecular and cellular levels affect the health of the organism. (5.3.12.A.3)		
• Plants, invertebrates, and vertebrates have multiple, nonspecific immune responses. • Mammals use specific immune responses triggered by natural or artificial agents that disrupt dynamic homeostasis. (5.3.12.A.3; 5.3.12.A.6)		
• In plants, physiological events involve interactions between environmental stimuli		

KNOW		UNDERSTAND	DO
Students will know that:		***Students will understand that:***	***Students will be able to:***
	and internal molecular signals. (5.3.12.A.3)		
	• In animals, internal and external signals regulate a variety of physiological responses that synchronize with environmental cycles and cues. (5.3.12.A.3)		
	• In fungi, protists and bacteria, internal and external signals regulate a variety of physiological responses that synchronize with environmental cycles and cues. (5.3.12.A.3)		
	• Signal transmission within and between cells mediates cell function.		
	• Communication involves transduction of stimulatory or inhibitory signals from other cells, organisms or the environment. (5.3.12.A.3)		
	• In single-celled organisms, signal transduction pathways influence how the cell responds to the environment. (5.3.12.A.3)		

KNOW		UNDERSTAND	DO
Students will know that:		***Students will understand that:***	***Students will be able to:***
	• In multi-cellular organisms, signal transduction pathways coordinate the activities within individual cells that support the function of the organism as a whole. (5.3.12.A.3)		
	• Cells communicate by cell-to-cell contact. • Cells communicate over short distances by using local regulators that target cells in the vicinity of the emitting cell. • Signals released by one cell type can travel long distances to target cells of another cell type. • Signaling begins with the recognition of a chemical messenger by a receptor protein. • Signal transduction is the process by which a signal is converted to a cellular response. • Conditions where signal transduction is blocked or defective can be deleterious, preventative or prophylactic. (5.3.12.A.3; 5.3.12.A.6)		

KNOW		UNDERSTAND	DO
Students will know that:		***Students will understand that:***	***Students will be able to:***
	• The neuron is the basic structure of the nervous system that reflects function. • Action potentials propagate impulses along neurons. • Transmission of information between neurons occurs across synapses. • Different regions of the vertebrate brain have different functions. (5.3.12.A.3; 5.3.12.A.6)		

21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		
Learning Activities		
Performance Assessment Task Sample		

Assessment Models

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Open-Ended Assessment:

- Sample AP Assessments

Open-Ended (Formative) Assessment:

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Summative Assessment:

- Assessment questions should be open-ended and should follow the general format illustrated in the Essential Questions/Sample Conceptual Understanding section. *(Synthesis, Analysis, Evaluation)*
- Assessment strategies will address a diverse array of learning modalities.
- Students will be given quizzes that provide a brief review of the concepts and skills in the previous lessons.
- Students will be given a chapter test to assess to review skills and concepts in this unit.
- Students will record laboratory data in written formal lab reports when assigned and through the use of iPad2 technology.

Additional Resources

BIG IDEA V: Change

Curriculum Management System
COURSE NAME: AP Biology

OVERARCHING GOALS

1. All students will understand that science is both a body of knowledge and evidence-based, model-building enterprise that continually extends, refines, and revises knowledge.
2. Investigate, research, and synthesize data and information to understand meaningful real-world problems.

ESSENTIAL QUESTIONS

- How does sexual reproduction contribute to both genetic variability and to maintenance of unity of the species?
- How has the study of genetics and heredity impacted our understanding of human health?

SUGGESTED BLOCKS FOR INSTRUCTION: 30

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
• Observable cell differentiation results from the expression of genes for tissue-specific proteins. (5.3.12.D.1) • Induction of transcription factors during development results in sequential gene expression. (5.3.12.D.1) • Programmed cell death (apoptosis) plays a role in normal development and differentiation. • Mitosis passes a complete genome from the parent cell to daughter cells. (5.3.12.D.3) • DNA and RNA are carriers of genetic information through transcription, translation and replication. • All modern organisms share major features of the genetic code. • Genetic Information	• The cell cycle is a complex set of stages that is highly regulated with checkpoints, which determine the ultimate fate of the cell. • Differentiation in development is due to external and internal cues that trigger gene regulation by proteins that bind DNA. • DNA and RNA molecules have structural similarities and differences that define function. • Phenotypes are determined through protein activities. • Segregation and independent assortment of chromosomes result in genetic variation. • Many ethical, social and medical issues surround human genetic disorders. • In eukaryotes, gene expression is complex and control involves regulatory genes, regulatory elements and transcription factors that act in concert. • Gene regulation accounts for some of the phenotypic differences between organisms with similar genes. • Changes in genotype may affect phenotypes that are subject to natural selection. • Genetic changes that enhance survival and reproduction can be selected by environmental conditions. • The imperfect nature of DNA replication and repair increases variation. • The horizontal transmission of genetic information in prokaryotes increases variation. • Sexual reproduction in eukaryotes increases variation. • The reproductive cycles of viruses facilitate transfer of genetic information. **Sample Conceptual Understandings** Reproduction can be either asexual or sexual. a. Using a specific example, **describe** how organisms can reproduce asexually. **Discuss** TWO evolutionary advantages of asexual reproduction. b. **Identify** THREE ways that sexual reproduction increases genetic variability. For each, **explain** how it increases genetic diversity among the offspring. **c.** **Discuss** TWO prezygotic isolating mechanisms that prevent hybridization between two species. Include in your discussion an example of each mechanism.	• Connect concepts to show that timing and coordination of specific events are necessary for normal development in an organism and that these events are regulated by multiple mechanisms. • Describe the roll of apoptosis in development and differentiation, the reuse of molecules and the maintenance of dynamic homeostasis. • Construct an explanation, using visual representations or models, as to how DNA in chromosomes is transmitted to the next generation via mitosis. • Make predictions

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
is transmitted from one generation to the next through DNA or RNA. • Genetic information flows from a sequence of nucleotides in a gene to a sequence of amino acids in a protein. (5.3.12.D.1)	A new species of fly was discovered on an island in the South Pacific. Several different crosses were performed, each using 100 females and 100 males. The phenotypes of the parents and the resulting offspring were recorded. Cross I: True-breeding bronze-eyed males were crossed with true-breeding red-eyed females. All the F_1 offspring had bronze eyes. F_1 flies were crossed, and the data for the resulting F_2 flies are given in the table below. **F_2 Phenotype** / **Male** / **Female** Bronze eyes / 3,720 / 3,800 Red eyes / 1,260 / 1,320 Cross II: True-breeding normal-winged males were crossed with true-breeding stunted-winged females. All the F_1 offspring had stunted wings. F_1 flies were crossed, and the data for the resulting F_2 flies are given in the table below. **F_2 Phenotype** / **Male** / **Female** Normal wings / 1,160 / 1,320 Stunted wings / 3,600 / 3,820 Cross III: True-breeding bronze-eyed, stunted-winged males were crossed with true-breeding red-eyed, normal-winged females. All the F_1 offspring had bronze eyes and stunted wings. The F_1 flies were crossed with true-breeding red-eyed, normal-winged flies, and the results are shown in the table below. **Phenotype** / **Male** / **Female** Bronze eyes, stunted wings / 2,360 / 2,220 Bronze eyes, normal wings / 220 / 300 Red eyes, stunted wings / 260 / 220 Red eyes, normal wings / 2,240 / 2,180 (a) What conclusions can be drawn from cross I and cross II? **Explain** how the data support your conclusions for each cross. (b) What conclusions can be drawn from the data from cross III? **Explain** how the data support your conclusions. (c) **Identify** and **discuss** TWO different factors that would affect whether the island's fly population is in Hardy-Weinberg equilibrium for the traits above.	about natural phenomena occurring during the cell cycle. • Describe the events of the cell cycle. • Construct explanations that use the structures and mechanisms of DNA and RNA to support the claim that DNA or RNA are the primary sources of heritable information. • Describe representations and models that illustrate how genetic information is copied for transmission between generations. • Predict how a change in specific DNA or RNA sequence can result in changes
• Genetic engineering techniques can manipulate the heritable information of DNA and RNA. (5.3.12.D.2)		
• Meiosis followed by fertilization ensures genetic diversity in sexually reproducing organisms. (5.3.12.D.3)		
• Rules of probability can be applied to analyze passage of single gene traits from parent to offspring. (5.3.12.D.3)		
• Certain human genetic disorders can be attributed to the		

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
inheritance of single gene traits or specific chromosomal changes. (5.3.12.D.3)	The flow of genetic information from DNA to protein in eukaryotic cells is called the central dogma of biology. a. **Explain** the role of each of the following in protein synthesis in eukaryotic cells. • RNA polymerase • Spliceosomes (snRNPs) • Codons • Ribosomes • tRNA b. Cells regulate both protein synthesis and protein activity. **Discuss** TWO specific mechanisms of protein regulation in eukaryotic cells. c. The central dogma does not apply to some viruses. **Select** a specific virus or type of virus and **explain** how it deviates from the central dogma.	in gene expression. • Construct an explanation, using visual representations or models, as to how DNA in chromosomes is transmitted to the next generation via meiosis followed by fertilization. • Represent the connection between meiosis and increased genetic diversity necessary for evolution. • Construct a representation that connects the process of meiosis to the passage of traits from parents to offspring. • Pose questions about ethical, social or medical issues
• Many traits are the product of multiple genes and/or physiological processes. (5.3.12.D.1; 5.3.12.D.3)		
• Genes on sex chromosomes determine some traits. (5.3.12.D.1; 5.3.12.D.3)		
• Some traits result from nonnuclear inheritance. (5.3.12.D.1; 5.3.12.D.3)		
• DNA regulatory sequences, regulatory genes and small regulatory RNAs are involved in gene expression. • Both positive and negative control mechanisms regulate gene expression in bacteria and viruses.		

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
(5.3.12.D.1)		surrounding human genetic disorders. • Apply mathematical routines to determine Mendelian patterns of inheritance provided by data sets. • Explain deviations from Mendel's model of the inheritance of traits. • Describe representations of an appropriate example of inheritance patterns that cannot be explained by Mendel's model. • Describe the connection between the regulation of gene expression and observed differences
• Signal transmission within and between cells mediates gene expression. (5.3.12.D.1)		
• Alterations in a DNA sequence can lead to changes in the type or amount of the protein produced and the consequent phenotype. • Errors in DNA replication or DNA repair mechanisms, and external factors can cause mutations in DNA. (5.3.12.D.1; 5.3.12.D.2)		
• Errors in mitosis or meiosis can result in changes in phenotype. (5.3.12.D.2; 5.3.12.D.3)		
• Viral replication differs from other reproductive strategies and generates genetic variation via various		

KNOW *Students will know that:*	UNDERSTAND *Students will understand that:*	DO *Students will be able to:*
mechanisms. (5.3.12.D.1)		between different kinds of organisms. • Explain how the regulation of gene expression is essential for the processes and structures that support efficient cell function. • Use representations to describe how gene regulation influences cell products and function. • Explain how signal pathways mediate gene expression. • Use representations to describe mechanisms of regulation of gene expression. • Predict how a change in genotype, when expressed as a phenotype,
• Multiple copies of alleles or genes nay provide new phenotypes. (5.3.12.D.1)		
• Environmental factors influence many traits both directly and indirectly. (5.3.12.D.1)		

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
		provides variation for natural selection. • Create a visual representation to illustrate how changes in a DNA sequence can result in a change in the polypeptide produced. • Compare and contrast processes by which genetic variation is produced and maintained in organisms from multiple domains. • Construct an explanation of the multiple processes that increase variation within a population. • Use representations and models to describe how viral replication introduces genetic variation in the

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
		viral population and also the host organism.

21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		

Learning Activities	
Mitosis/Meiosis lab (AP Lab #3) Molecular Biology Lab (AP Lab #6) Genetics Lab (AP Lab #7)	
Performance Assessment Task Sample	

Assessment Models

- **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).**
- **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.**

Open-Ended Assessment:

- Sample AP Assessments

Open-Ended (Formative) Assessment:

- Differentiated group and individual work is assigned daily, from various sources *(Synthesis, Analysis, and Evaluation).*
- Introductory and Closing Activities will be done every day to pre-assess student knowledge and assess understanding of topics *(Synthesis, Analysis, and Evaluation).*
- Laboratory activities to reinforce and assess application of concepts and skills.

Summative Assessment:

- Assessment questions should be open-ended and should follow the general format illustrated in the Essential Questions/Sample Conceptual Understanding section. *(Synthesis, Analysis, Evaluation)*
- Assessment strategies will address a diverse array of learning modalities.
- Students will be given quizzes that provide a brief review of the concepts and skills in the previous lessons.
- Students will be given a chapter test to assess to review skills and concepts in this unit.
- Students will record laboratory data in formal lab reports when assigned and through the use of iPad2 technology.

Additional Resources

BIG IDEA VI:

BIG IDEA VI: Behavior

Curriculum Management System
COURSE NAME: AP Biology

OVERARCHING GOALS

1. All students will understand that science is both a body of knowledge and evidence-based, model-building enterprise that continually extends, refines, and revises knowledge.
2. Investigate, research, and synthesize data and information to understand meaningful real-world problems.

ESSENTIAL QUESTIONS

- How do the ideas of natural selection and descent with modification explain the majority of biological phenomenon?

SUGGESTED BLOCKS FOR INSTRUCTION: 30

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
• Competition for limited resources results in differential survival • Individuals with more favorable phenotypes are more likely to survive and produce more offspring (5.3.12.E.3; 5.3.12.E.4)	• Evolutionary fitness is measured by reproductive success. • A diverse gene pool is important for the survival of a species in a changing environment. • Phenotypic variations are not directed by the environment, but occur through random changes in the DNA and through new gene combinations. • Humans impact variation in other species. • Reduction of genetic variation within a given population can increase the differences between populations of the same species. • Mathematical models and simulations can be used to illustrate and support evolutionary concepts. • Phylogenetic trees and cladograms illustrate speciation that has occurred. • Phylogenetic trees and cladograms are dynamic, based on the biological data used, new mathematical and computational ideas, and current and emerging knowledge. • New species arise from reproductive isolation over time, which can involve scales of hundreds of thousands or even millions of years, or speciation can occur rapidly. • Evolution is an ongoing process • Speciation rates can vary, especially when adaptive radiation occurs when new habitats become available. • Species extinction rates are rapid at times of ecological stress.	• 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. • Apply mathematical methods to data from a real or simulated population to predict what will happen to the population in the future. • Connect evolutionary changes in a
• Environments change and act as a selective mechanism on organisms. (5.3.12.E.4)		
• Chance and random events can influence the evolutionary process, especially for small populations. • Genetic drift is a nonselective process occurring in small populations. (5.3.12.E.3)		
• Scientific evidence of biological evolution uses information from geographical, geological, physical,		

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
chemical and mathematical applications. • Molecular, morphological and genetic information of existing and extinct organisms add to our understanding of evolution. (5.3.12.E.2)	**Sample Conceptual Understanding** . Phylogeny is the evolutionary history of a species. (a) The evolution of a species is dependent on changes in the genome of the species. **Identify** TWO mechanisms of genetic change, and **explain** how each affects genetic variation. (b) Based on the data in the table below, **draw** a phylogenetic tree that reflects the evolutionary relationships of the organisms based on the differences in their cytochrome *c* amino-acid sequences and **explain** the relationships of the organisms. Based on the data, **identify** which organism is most closely related to the chicken and **explain** your choice. (c) **Describe** TWO types of evidence—other than the comparison of proteins—that can be used to determine the phylogeny of organisms. **Discuss** one strength of each type of evidence you described. THE NUMBER OF AMINO ACID DIFFERENCES IN CYTOCHROME *c* AMONG VARIOUS ORGANISMS	population over time to a change in the environment • 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. • Make predictions about the effects of genetic drift, migration, and artificial selection on the genetic makeup of a population • Evaluate and refine evidence based on data from many scientific disciplines that support biological evolution • Design a plan to answer scientific
• Structural and functional evidence supports the relatedness of all domains • Structural evidence supports the relatedness of all eukaryotes. (5.3.12.E.2, 5.3.12.E.3)		
• Phylogenetic trees and cladograms can represent traits that are either derived or lost due to evolution. (5.3.12.E.1; 5.3.12.E.2; 5.3.12.E.3)		
• Speciation results in		

	Horse	Donkey	Chicken	Penguin	Snake
Horse	0	1	11	13	21
Donkey		0	10	12	20
Chicken			0	3	18
Penguin				0	17
Snake					0

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
diversity of life forms. • A geographic barrier can physically separate species, or various pre- and post-zygotic mechanisms can maintain reproductive isolation and prevent gene flow. (5.3.12.E.1)		questions regarding how organisms have changed over time using information morphology, biochemistry and geology • Create a phylogenetic tree or cladogram that correctly represents evolutionary history and speciation from a provided data set. • Analyze data related to questions of speciation and extinction throughout the Earth's history • Describe speciation in an isolated population and connect it to change in gene frequency, change in environment,
• Interactions and coordination between organs provide essential biological activities. • Interactions between systems provide essential biological activities. (5.3.12.E.4)		

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
		natural selection, and/or genetic drift. • Describe a scientific hypothesis about the origin of life on Earth. • Describe reasons for revisions of scientific hypotheses about the origin of life on Earth. • Predict the effects of a change in a component of a biological system on the functionality of the organism.

21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		

Learning Activities	
Population Genetics Lab (AP #8) Animal Diversity Dissection Set	
Performance Assessment Task Sample	

Assessment Models

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- **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.**

Open-Ended Assessment:

- Sample AP Assessments

Open-Ended (Formative) Assessment:

- Differentiated group and individual work is assigned daily, from various sources *(Synthesis, Analysis, and Evaluation).*
- Introductory and Closing Activities will be done every day to pre-assess student knowledge and assess understanding of topics *(Synthesis, Analysis, and Evaluation).*
- Laboratory activities to reinforce and assess application of concepts and skills.

Summative Assessment:

- Assessment questions should be open-ended and should follow the general format illustrated in the Essential Questions/Sample Conceptual Understanding section. *(Synthesis, Analysis, Evaluation)*
- Assessment strategies will address a diverse array of learning modalities.
- Students will be given quizzes that provide a brief review of the concepts and skills in the previous lessons.
- Students will be given a chapter test to assess to review skills and concepts in this unit.
- Students will record laboratory data in written lab reports when assigned and through the use of iPad2 technology.

Additional Resources

BIG IDEA VII: Systems

Curriculum Management System
COURSE NAME: AP Biology

OVERARCHING GOALS

1. All students will understand that science is both a body of knowledge and evidence-based, model-building enterprise that continually extends, refines, and revises knowledge.
2. Investigate, research, and synthesize data and information to understand meaningful real-world problems.

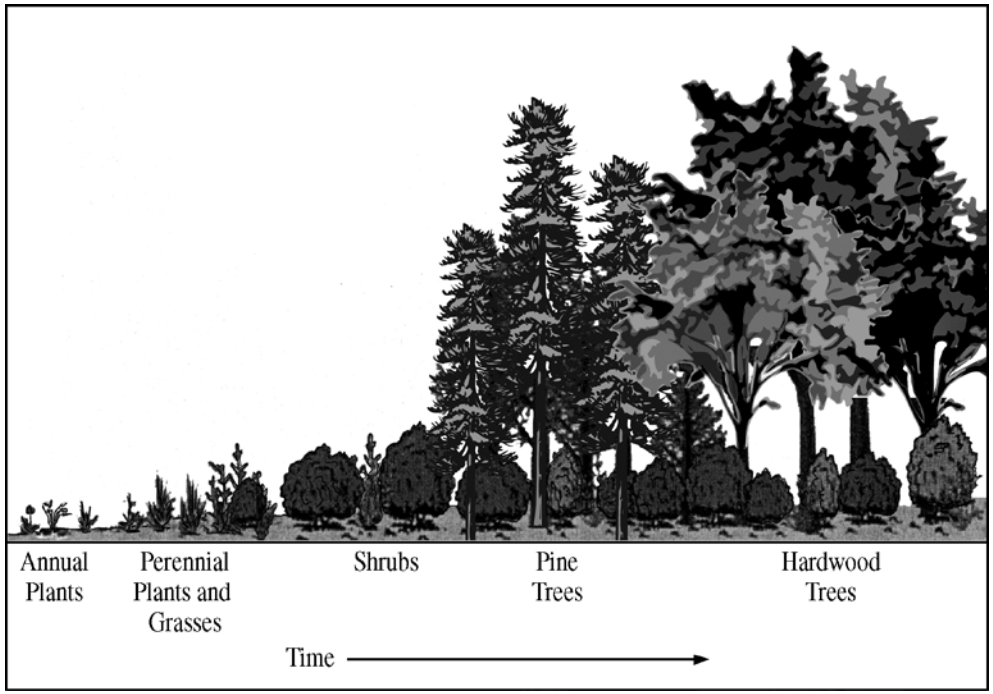
ESSENTIAL QUESTIONS

- How do different species depend on each other for survival?
- In what ways can removal, or addition, of a single species impact an ecosystem?

SUGGESTED BLOCKS FOR INSTRUCTION: 20

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
• Changes in free energy availability can result in changes in population size. • Changes in free energy availability can result in disruptions to an ecosystem. • Energy flows, but matter is recycled. (5.3.12.B.1; 5.3.12.B.2; 5.3.12.B.3; 5.3.12.C.1)	• Organism activities are affected by interactions with biotic and abiotic factors. • The stability of populations, communities, and ecosystems is affected by interactions with biotic and abiotic factors. • Responses to information and communication of information are vital to natural selection. • Organisms exchange information with each other in response to internal changes and external cues, which can change behavior. • Reponses to information and communication of information are vital to natural selection and evolution. • Models allow the prediction of the impact of change in biotic and abiotic factors. • Human activities impact ecosystems on local, regional and global scales. • A population has properties that are different from those of the individuals that make up the population.	• Predict how changes in free energy availability affect organisms, populations and ecosystems. • Design a plan for collecting data to show that all biological systems are affected by complex biotic and abiotic interactions. • Analyze data to identify possible patterns and relationships between a biotic or abiotic factor and a biological system. • Use models to analyze the effects of a disruption on an ecosystem. • Predict how environmental factors affect responses to information and change behavior. • Describe how
• Disruptions to ecosystems impact the dynamic homeostasis or balance of the ecosystem. • Changes in regional and global climates and in atmospheric composition influence patterns of primary productivity. (5.3.12.C.2)		
• Individuals can act on information and communicate it to others. • Communication occurs through various mechanisms. (5.3.12.C.1)		

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
• The structure of a community is measured and described in terms of species composition and species diversity. (5.3.12.C.1)	**Sample Conceptual Understanding**	organisms exchange information in response to internal changes or environmental cues. • Apply mathematical routines to quantities that describe communities composed of organisms that interact in complex ways. • Predict the effects of a change in matter or energy availability on a community.
• Mathematical or computer models are used to illustrate and investigate population interactions within and environmental impacts on a community. • Mathematical models and graphical representations are used to illustrate population growth patterns and interactions. (5.3.12.C.1)		
• Organisms within food webs interact. • Food webs are dependent on primary productivity. (5.3.12.B.1; 5.3.12.B.3; 5.3.12.C.1)		
• Many adaptations of organisms are related to obtaining and using		

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
energy and matter in a particular environment. (5.3.12.B.6; 5.3.12.C.1)		
• Interactions between populations affect the distribution and abundance of populations. (5.3.12.C.1)		
• Geological and meteorological events impact ecosystem distribution. (5.3.12.C.1)		
	The diagram above shows the succession of communities from annual plants to hardwood trees in a specific area over a period of time. (a) **Discuss** the expected changes in biodiversity as the stages of succession progress as shown in the diagram above. (b) **Describe** and **explain** THREE changes in abiotic conditions over time that lead to the succession, as shown in the diagram above. (c) For each of the following disturbances, **discuss** the immediate and long-term effects on ecosystem succession. (i) A volcano erupts, covering a 10-square-kilometer portion of a mature forest with lava. (ii) A 10- square-kilometer portion of a mature forest is clear-cut.	

21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		
Learning Activities		
Animal Behavior Lab (AP Lab #11) Dissolved Oxygen Lab (AP #12)		
Performance Assessment Task Sample		

COURSE NAME: AP BIOLOGY

1. The student will be able to describe the structure and function of the major organelles found in plant and animal cells as well as describe membrane structure and function.
2. The student will be able to explain how an organism's metabolism transforms matter and energy subject to the laws of thermodynamics and describe the role of enzymes in biological reactions.
3. The student will be able to describe the general processes and functions of cellular respiration and fermentation.
4. The student will be able to describe the general process by which light energy is converted into chemical energy in photosynthesis.
5. The student will be able to describe the cell cycle and explain how it is regulated.
6. The student will be able to describe the function and structure of DNA and RNA
7. The student will be able to explain the processes of transcription and translation.
8. The student will be able to explain the genetics of viruses and bacteria.
9. The student will be able to discuss the eukaryotic genome in terms of organization, regulation and evolution.
10. The student will be able to define and describe the concept of descent with modification.
11. The student will be able to describe how plants colonized land and explain the evolution of the seed plant.
12. The student will be able to describe organism responses to internal and external signals.
13. The student will be able to describe the great diversity found among invertebrates and vertebrate animals.
14. The student will be able to analyze and discuss osmoregulation and excretion found among animals,
15. The student will be able to define ecology and the interactions of the biosphere.
16. The student will be able to define population ecology and community ecology.
17. The student will be able to define ecosystem