

## AP Biology 4180

**Description** This course is designed to be the equivalent of the introductory General Biology and Biology Lab class taken at the college level. A strong laboratory component provides students with opportunities to experience advanced lab techniques, and to develop strong critical thinking skills. Course topics include biochemistry, cellular biology, genetics/biotechnology, evolution, taxonomy, and anatomy and physiology. This course will prepare students for the Advanced Placement Biology Test.

**Credits** 1

**Prerequisites** Biology or Biophysical Science; Chemistry

**Textbooks/Resources** Urry, Lisa A., Cain, Michael L., Wasserman, Peter V., Reece, Jane B., and Campbell, Neil A. *Biology in Focus*, 2nd ed. Pearson Education Inc., 2017.  
ISBN: 978-0-13-427891-9

**Required Assessments** Standards-based district-wide assessment

**Board Approved** May 2006

**Revised** August 2016

### AASD Science Goals for K-12 Students

- Students will demonstrate understanding of key science concepts and apply them to their world.
- Students will demonstrate knowledge and understanding that scientific knowledge is continually undergoing revision and refinement based on new experiments and data.
- Students will demonstrate knowledge and understanding that the process of science is based on questioning and providing empirical evidence to support claims.
- Students will apply scientific concepts and processes to evaluate consequences and make informed, responsible choices (regarding self, others, environment).
- Students will demonstrate understanding that science and technology are critical in order to provide and evaluate alternative solutions to problems in our world.
- Students will engage in STEM experiences as both scientists and engineers in order to prepare for postsecondary and career readiness .

## **AASD Science Standards for Students in AP Biology (4180)**

### **Science & Engineering Practices**

1. Asking Questions and Defining Problems
2. Developing and Using Models
3. Planning and Carrying Out Investigations
4. Analyzing and Interpreting Data
5. Using Mathematics, Information and Computer Technology, and Computational Thinking
6. Constructing Explanations and Designing Solutions
7. Engaging in Argument from Evidence
8. Obtaining, Evaluating, and Communicating Information

### **AP Biology Content Power Standards:**

1. The process of evolution drives the diversity and unity of life.
2. Biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.
3. Living systems store, retrieve, transmit, and respond to information essential to life processes.
4. Biological systems interact, and these systems and their interactions possess complex properties.

## **AASD Next Generation Science Standards**

### **High School Physical Sciences (HS-PS)**

#### **Matter and Its Interactions**

By the end of **grade twelve**, students will:

- |          |   |
|----------|---|
| HS-PS1-1 | Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms  |
| HS-PS1-2 | Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties |
| HS-PS1-3 | Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles  |
| HS-PS1-4 | Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes   |

- in total bond energy
- HS-PS1-5 Apply scientific principles and evidence to provide an explanation about the effects of changing temperature or concentration of the reacting particles on the rate at which a reaction occurs.
- HS-PS1-6 Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium
- HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction
- HS-PS1-8 Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay

### **Motion and Stability: Forces and Interactions**

By the end of **grade twelve**, students will:

- HS-PS2-1 Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration
- HS-PS2-2 Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system
- HS-PS2-3 Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision
- HS-PS2-4 Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects
- HS-PS2-5 Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current
- HS-PS2-6 Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials

### **Energy**

By the end of **grade twelve**, students will:

- HS-PS3-1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known
- HS-PS3-2 Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motion of particles (objects) and energy associated with the relative position of particles (objects)
- HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy in another form of energy
- HS-PS3-4 Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics)
- HS-PS3-5 Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction

**Waves and Their Applications in Technologies for Information Transfer**

By the end of **grade twelve**, students will:

- HS-PS4-1 Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media
- HS-PS4-2 Evaluate questions about the advantages of using a digital transmission and storage of information
- HS-PS4-3 Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be describe either by a wave model or a particle model, and that for some situations one model is more useful than the other
- HS-PS4-4 Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter
- HS-PS4-5 Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy

**High School Life Sciences (HS-LS)****From Molecules to Organisms: Structures and Processes**

By the end of **grade twelve**, students will:

- HS-LS1-1 Construct and explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells
- HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms
- HS-LS1-3 Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis
- HS-LS1-4 Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms
- HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy
- HS-LS1-6 Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules
- HS-LS1-7 Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy

**Ecosystems: Interactions, Energy, and Dynamics**

By the end of **grade twelve**, students will:

- HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales
- HS-LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales
- HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions
- HS-LS2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem
- HS-LS2-5 Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere
- HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem
- HS-LS2-7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity
- HS-LS2-8 Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce

**Heredity: Inheritance and Variation of Traits**

By the end of **grade twelve**, students will:

- HS-LS3-1 Ask questions to clarify relationship about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring
- HS-LS3-2 Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors
- HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population

**Biological Evolution: Unity and Diversity**

By the end of **grade twelve**, students will:

- HS-LS4-1 Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical Evidence
- HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment
- HS-LS4-3 Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait
- HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations

- HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species
- HS-LS4-6 Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity

## High School Earth Sciences (HS-ES)

### Earth's Place in the Universe

By the end of **grade twelve**, students will:

- HS-ESS1-1 Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation
- HS-ESS1-2 Construct and explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe
- HS-ESS1-3 Communicate scientific ideas about the way stars, over their life cycle, produce elements
- HS-ESS1-4 Use mathematical or computation representations to predict the motion of orbiting objects in the solar system
- HS-ESS1-5 Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks
- HS-ESS1-6 Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history

### Earth's Systems

By the end of **grade twelve**, students will:

- HS-ESS2-1 Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features
- HS-ESS2-2 Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems
- HS-ESS2-3 Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection
- HS-ESS2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate
- HS-ESS2-5 Plan and conduct an investigation of the properties of water and its effect on Earth materials and surface processes
- HS-ESS2-6 Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere
- HS-ESS2-7 Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth

**Earth and Human Activity**

By the end of **grade twelve**, students will:

- HS-ESS3-1 Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity
- HS-ESS3-2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios
- HS-ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity
- HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems
- HS-ESS3-5 Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems
- HS-ESS3-6 Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity

**High School Engineering Design (HS-ET)****Engineering Design**

By the end of **grade twelve**, students will:

- HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
- HS-ETS1-2 Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering
- HS-ETS1-3 Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts
- HS-ETS1-4 Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem

## AP Biology Power Standard 1: The process of evolution drives the diversity and unity of life.

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>1. Student develops a deep understanding of science by engaging in age-appropriate science and engineering habits.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. asks questions and defines problems.</li> <li>b. develops and uses models.</li> <li>c. plans and carries out investigations.</li> <li>d. analyzes and interprets data.</li> <li>e. uses mathematics, information and computer technology, and computational thinking.</li> <li>f. constructs explanations and designs solutions.</li> <li>g. engages in argument from evidence.</li> <li>h. obtains, evaluates, and communicates information.</li> </ul>	<ul style="list-style-type: none"> <li>● Quizzes and tests</li> <li>● Projects</li> <li>● Research</li> <li>● Performance assessment</li> </ul>
<p><b>Objectives are linked to the Science and Engineering Practices</b></p>		



Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>2. Student demonstrates understanding of how change in the genetic makeup of a population over time is evolution.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. demonstrates an understanding that natural selection is a major mechanism of evolution (1.A.1).</li> <li>b. demonstrates an understanding that natural selection acts on phenotypic variations in populations (1.A.2).</li> <li>c. explains how evolutionary change is also driven by random processes (1.A.3).</li> <li>d. shows how biological evolution is supported by scientific evidence from many disciplines, including mathematics (1.A.4).</li> </ul>	<ul style="list-style-type: none"> <li>• Quizzes and tests</li> <li>• Projects</li> <li>• Research</li> <li>• Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>• AP Lab 1 Artificial Selection</li> <li>• AP Lab 2 Mathematical Modeling: Hardy-Weinberg</li> <li>• AP Lab 3 Comparing DNA Sequences To Understand Evolutionary Relationships with BLAST</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>• Lab 3 Mitosis and Meiosis</li> <li>• Lab 8 Population Genetics and Evolution</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS4-1, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5, HS-LS4-6</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>3. Student demonstrates understanding of how organisms are linked by lines of descent from common ancestry.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <p>a. understands organisms share many conserved core processes and features that evolved and are widely distributed among organisms today (1.B.1).</p> <p>b. understands phylogenetic trees and cladograms are graphical representations (models) of evolutionary history that can be tested (1.B.2).</p>	<ul style="list-style-type: none"> <li>● Quizzes and tests</li> <li>● Projects</li> <li>● Research</li> <li>● Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>● AP Lab 1 Artificial Selection</li> <li>● AP Lab 2 Mathematical Modeling: Hardy-Weinberg</li> <li>● AP Lab 3 Comparing DNA Sequences To Understand Evolutionary Relationships with BLAST</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>● Lab 3 Mitosis and Meiosis</li> <li>● Lab 8 Population Genetics and Evolution</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS4-1, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5, HS-LS4-6</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>4. Student demonstrates understanding of how life continues to evolve within a changing environment.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. explains how speciation and extinction have occurred throughout the Earth's history (1.C.1).</li> <li>b. understands how speciation may occur when two populations become reproductively isolated from each other (1.C.2).</li> <li>c. understands how populations or organisms continue to evolve (1.C.3).</li> </ul>	<ul style="list-style-type: none"> <li>• Quizzes and tests</li> <li>• Projects</li> <li>• Research</li> <li>• Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>• AP Lab 1 Artificial Selection</li> <li>• AP Lab 2 Mathematical Modeling: Hardy-Weinberg</li> <li>• AP Lab 3 Comparing DNA Sequences To Understand Evolutionary Relationships with BLAST</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>• Lab 3 Mitosis and Meiosis</li> <li>• Lab 8 Population Genetics and Evolution</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS4-1, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5, HS-LS4-6</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>5. Student demonstrates understanding that the origin of living systems is explained by natural processes.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <p>a. understands there are several hypothesis about the natural origin of life on earth, each with supporting scientific evidence (1.D.1).</p> <p>b. explains how scientific evidence from many different disciplines supports models of the origin of life (1.D.2).</p>	<ul style="list-style-type: none"> <li>● Quizzes and tests</li> <li>● Projects</li> <li>● Research</li> <li>● Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>● AP Lab 1 Artificial Selection</li> <li>● AP Lab 2 Mathematical Modeling: Hardy-Weinberg</li> <li>● AP Lab 3 Comparing DNA Sequences To Understand Evolutionary Relationships with BLAST</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>● Lab 8 Population Genetics and Evolution</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS4-1, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5, HS-LS4-6</p>		

## AP Biology Power Standard 2: Biological systems utilize free energy and molecular building blocks to grow, to reproduce, and to maintain dynamic homeostasis.

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>6. Student demonstrates understanding of how growth, reproduction, and maintenance of the organization of living systems requires free energy and matter.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. identifies that all living systems require constant input of energy (2.A.1).</li> <li>b. explains how organism capture and store free energy for use in biological processes (2.A.2).</li> <li>c. understands how organisms must exchange matter with the environment to grow, reproduce, and maintain organization (2.A.3).</li> </ul>	<ul style="list-style-type: none"> <li>• Quizzes and tests</li> <li>• Projects</li> <li>• Research</li> <li>• Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>• AP Lab 4 Diffusion and Osmosis</li> <li>• AP Lab 5 Photosynthesis</li> <li>• AP Lab 6 Cellular Respiration</li> <li>• AP Lab 10 Energy Dynamics</li> <li>• AP Lab 13 Enzyme Activity</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>• Lab 1 Diffusion and Osmosis</li> <li>• Lab 2 Enzyme Catalysis</li> <li>• Lab 4 Plant Pigments and Photosynthesis</li> <li>• Lab 5 Cellular Respiration</li> <li>• Lab 9 Transpiration</li> <li>• Lab 10 Physiology of the Circulatory System</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS1-4, HS-LS1-5, HS-LS1-6, HS-LS1-7</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>7. Student demonstrates understanding of how growth, reproduction, and dynamic homeostasis require that cells create and maintain internal environments that are different from their external environments.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. explains how cell membranes are selectively permeable due to their structure (2.B.1).</li> <li>b. explains how growth and dynamic homeostasis are maintained by the constant movement of molecules across membranes (2.B.2).</li> <li>c. explains how eukaryotic cells maintain internal membranes that partition the cell into specialized compartments (2.B.3).</li> </ul>	<ul style="list-style-type: none"> <li>● Quizzes and tests</li> <li>● Projects</li> <li>● Research</li> <li>● Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>● AP Lab 4 Diffusion and Osmosis</li> <li>● AP Lab 5 Photosynthesis</li> <li>● AP Lab 6 Cellular Respiration</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>● Lab 1 Diffusion and Osmosis</li> <li>● Lab 2 Enzyme Catalysis</li> <li>● Lab 4 Plant Pigments and Photosynthesis</li> <li>● Lab 5 Cellular Respiration</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS1-1, HS-LS1-2, HS-LS1-3, HS-LS1-4, HS-LS1-5, HS-LS1-6, HS-LS1-7</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>8. Student demonstrates understanding of how organisms use feedback mechanisms to regulate growth and reproduction, and to maintain dynamic homeostasis.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <p>a. explains how organisms use feedback mechanisms to maintain their internal environments and respond to external changes (2.C.1).</p> <p>b. explains how organisms respond to changes in their external environments (2.C.2).</p>	<ul style="list-style-type: none"> <li>● Quizzes and tests</li> <li>● Projects</li> <li>● Research</li> <li>● Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>● AP Lab 4 Diffusion and Osmosis</li> <li>● AP Lab 5 Photosynthesis</li> <li>● AP Lab 6 Cellular Respiration</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>● Lab 1 Diffusion and Osmosis</li> <li>● Lab 2 Enzyme Catalysis</li> <li>● Lab 4 Plant Pigments and Photosynthesis</li> <li>● Lab 5 Cellular Respiration</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS1-1, HS-LS1-2, HS-LS1-3, HS-LS1-4, HS-LS1-5, HS-LS1-6, HS-LS1-7</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>9. Student demonstrates understanding of how growth and dynamic homeostasis of a biological system are influenced by changes in the system's environment.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <p>a. understands how all biological systems from cells and organisms to populations, communities, and ecosystems are affected by complex biotic and abiotic interactions involving exchange of matter and free energy (2.D.1).</p> <p>b. explains how homeostatic mechanisms reflect both common ancestry and divergence due to adaptation in different environments (2.D.2).</p> <p>c. explains how biological systems are affected by disruptions to their dynamic homeostasis (2.D.3).</p> <p>d. understands how plants and animals have a variety of chemical defenses against infections that affect dynamic homeostasis (2.D.4).</p>	<ul style="list-style-type: none"> <li>● Quizzes and tests</li> <li>● Projects</li> <li>● Research</li> <li>● Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>● AP Lab 4 Diffusion and Osmosis</li> <li>● AP Lab 5 Photosynthesis</li> <li>● AP Lab 6 Cellular Respiration</li> <li>● AP Lab 7 Cell Division: Mitosis and Meiosis</li> <li>● AP Lab 10 Energy Dynamics</li> <li>● AP Lab 11 Transpiration</li> <li>● AP Lab 12 Fruit Fly Behavior</li> <li>● AP Lab 13 Enzyme Activity</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>● Lab 1 Diffusion and Osmosis</li> <li>● Lab 2 Enzyme Catalysis</li> <li>● Lab 3 Mitosis and Meiosis</li> <li>● Lab 4 Plant Pigments and Photosynthesis</li> <li>● Lab 5 Cellular Respiration</li> <li>● Lab 9 Transpiration</li> <li>● Lab 10 Physiology of the Circulatory System</li> <li>● Lab 11 Animal Behavior</li> <li>● Lab 12 Dissolved Oxygen and Aquatic Primary Productivity</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b>  HS-LS2-1, HS-L2-2, HS-LS2-3, HS-LS2-4, HS-LS2-5, HS-LS2-6, HS-LS2-7, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5, HS-LS4-6</p>		



Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>10. Student demonstrates understanding of how many biological processes involved in growth, reproduction, and dynamic homeostasis include temporal regulation and coordination.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <p>a. explains how timing and coordination of specific events are necessary for the normal development of an organism, and these events are regulated by a variety of mechanisms (2.E.1).</p> <p>b. explains how timing and coordination of physiological events are regulated by multiple mechanisms (2.E.2).</p> <p>c. explains how timing and coordination of behavior are regulated by various mechanisms and are important in natural selection (2.E.3).</p>	<ul style="list-style-type: none"> <li>● Quizzes and tests</li> <li>● Projects</li> <li>● Research</li> <li>● Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>● AP Lab 5 Photosynthesis</li> <li>● AP Lab 6 Cellular Respiration</li> <li>● AP Lab 7 Cell Division: Mitosis and Meiosis</li> <li>● AP Lab 10 Energy Dynamics</li> <li>● AP Lab 11 Transpiration</li> <li>● AP Lab 12 Fruit Fly Behavior</li> <li>● AP Lab 13 Enzyme Activity</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>● Lab 2 Enzyme Catalysis</li> <li>● Lab 3 Mitosis and Meiosis</li> <li>● Lab 4 Plant Pigments and Photosynthesis</li> <li>● Lab 5 Cellular Respiration</li> <li>● Lab 9 Transpiration</li> <li>● Lab 10 Physiology of the Circulatory System</li> <li>● Lab 11 Animal Behavior</li> <li>● Lab 12 Dissolved Oxygen and Aquatic Primary Productivity</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS1-1, HS-L1-2, HS-LS1-3, HS-L1-4, HS-LS2-8</p>		

## AP Biology Power Standard 3: Living systems store, retrieve, transmit, and respond to information essential to life processes.

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>11. Student demonstrates an understanding of how heritable information provides for the continuity of life.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. understands DNA, and in some cases RNA, is the primary source of heritable information (3.A.1).</li> <li>b. explains how in eukaryotes, heritable information is passed to the next generation via processes that include the cell cycle and mitosis and meiosis plus fertilization (3.A.2).</li> <li>c. explains how the chromosomal basis of inheritance provides for an understanding of the pattern of passage (transmission) of genes from parents to offspring (3.A.3).</li> <li>d. explains why inheritance pattern of many traits cannot be explained by simple Mendelian genetics (3.A.4).</li> </ul>	<ul style="list-style-type: none"> <li>• Quizzes and tests</li> <li>• Projects</li> <li>• Research</li> <li>• Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>• AP Lab 7 Cell Division: Mitosis and Meiosis</li> <li>• AP Lab 8 Biotechnology: Bacterial Transformation</li> <li>• AP Lab 9 Biotechnology: Restriction Enzyme Analysis of DNA</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>• Lab 3 Mitosis and Meiosis</li> <li>• Lab 6 Molecular Biology</li> <li>• Lab 7 Genetics of Organisms</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS3-1, HS-L3-2, HS-LS3-3, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5, HS-LS4-6</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>12. Student demonstrates an understanding of how expression of genetic information involves cellular and molecular mechanisms.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <p>a. explains how gene regulation results in differential gene expression, leading to cell specialization (3.B.1).</p> <p>b. explains how a variety of intercellular and intracellular signal transmissions mediate gene expression (3.B.2).</p>	<ul style="list-style-type: none"> <li>● Quizzes and tests</li> <li>● Projects</li> <li>● Research</li> <li>● Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>● AP Lab 7 Cell Division: Mitosis and Meiosis</li> <li>● AP Lab 8 Biotechnology: Bacterial Transformation</li> <li>● AP Lab 9 Biotechnology: Restriction Enzyme Analysis of DNA</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>● Lab 3 Mitosis and Meiosis</li> <li>● Lab 6 Molecular Biology</li> <li>● Lab 7 Genetics of Organisms</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS3-1, HS-LS3-2, HS-LS3-3, HS-LS1-4</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>13. Student demonstrates understanding of how the process of genetic information is imperfect and is a source of genetic variation.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. understands how changes in genotype can result in changes in phenotypes (3.C.1).</li> <li>b. understands how biological systems have multiple processes that increase genetic variation (3.C.2).</li> <li>c. explains how viral replication results in genetic variation, and viral infection can introduce genetic variation into the hosts (3.C.3).</li> </ul>	<ul style="list-style-type: none"> <li>● Quizzes and tests</li> <li>● Projects</li> <li>● Research</li> <li>● Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>● AP Lab 7 Cell Division: Mitosis and Meiosis</li> <li>● AP Lab 8 Biotechnology: Bacterial Transformation</li> <li>● AP Lab 9 Biotechnology: Restriction Enzyme Analysis of DNA</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>● Lab 3 Mitosis and Meiosis</li> <li>● Lab 6 Molecular Biology</li> <li>● Lab 7 Genetics of Organisms</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS3-1, HS-L3-2, HS-LS3-3, HS-LS4-2, HS-LS4-3, HS-LS4-4, HS-LS4-5, HS-LS4-6</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>14. Student demonstrates understanding of how cells communicate by generating, transmitting, and receiving chemical signals.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. understands how cell communication processes share common features that reflect a shared evolutionary history (3.D.1).</li> <li>b. explains how cells communicate with each other through direct contact with other cells or from a distance via chemical signals (3.D.2).</li> <li>c. explains how signal transduction pathways link signal reception with cellular response (3.D.3).</li> <li>d. explains how changes in signal transduction pathways can alter cellular response (3.D.4).</li> </ul>	<ul style="list-style-type: none"> <li>● Quizzes and tests</li> <li>● Projects</li> <li>● Research</li> <li>● Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>● AP Lab 7 Cell Division: Mitosis and Meiosis</li> <li>● AP Lab 8 Biotechnology: Bacterial Transformation</li> <li>● AP Lab 9 Biotechnology: Restriction Enzyme Analysis of DNA</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>● Lab 3 Mitosis and Meiosis</li> <li>● Lab 6 Molecular Biology</li> <li>● Lab 7 Genetics of Organisms</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS1-1, HS-LS1-2, HS-LS1-3, HS-LS1-4</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>15. Student demonstrates understanding of how transmission of information results in changes within and between biological systems.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <p>a. explains how individuals can act on information and communicate it to others (3.E.1).</p> <p>b. understands how animals have nervous systems that detect external and internal signals, transmit and integrate information, and produce a response (3.E.2).</p>	<ul style="list-style-type: none"> <li>● Quizzes and tests</li> <li>● Projects</li> <li>● Research</li> <li>● Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>● AP Lab 7 Cell Division: Mitosis and Meiosis</li> <li>● AP Lab 8 Biotechnology: Bacterial Transformation</li> <li>● AP Lab 9 Biotechnology: Restriction Enzyme Analysis of DNA</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>● Lab 3 Mitosis and Meiosis</li> <li>● Lab 6 Molecular Biology</li> <li>● Lab 7 Genetics of Organisms</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS2-8, HS-LS4-1, HS-LS4-2, HS-LS4-3</p>		

## AP Biology Power Standard 4: Biological systems interact, and these systems and their interactions possess complex properties.

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>16. Student demonstrates understanding of how interactions within biological systems lead to complex properties.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. explains how the subcomponents of biological molecules and their sequence determine the properties of that molecule (4.A.1).</li> <li>b. explains how structure and function of subcellular components, and their interactions, provide essential cellular processes (4.A.2).</li> <li>c. explains how interactions between external stimuli and regulated gene expression results in specialization of cells, tissues, and organs (4.A.3)</li> <li>d. explains how organism exhibit complex properties due to interactions between their constituent parts (4.A.4).</li> <li>e. understands that communities are composed of populations of organisms that interact in complex ways (4.A.5).</li> <li>f. understands how interactions among living systems and with their environments result in the movement of matter and energy (4.A.6).</li> </ul>	<ul style="list-style-type: none"> <li>• Quizzes and tests</li> <li>• Projects</li> <li>• Research</li> <li>• Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>• AP Lab 10 Energy Dynamics</li> <li>• AP Lab 11 Transpiration</li> <li>• AP Lab 12 Fruit Fly Behavior</li> <li>• AP Lab 13 Enzyme Activity</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>• Lab 2 Enzyme Catalysis</li> <li>• Lab 9 Transpiration</li> <li>• Lab 10 Physiology of the Circulatory System</li> <li>• Lab 11 Animal Behavior</li> <li>• Lab 12 Dissolved Oxygen and Aquatic Primary Productivity</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS1-1, HS-LS1-2, HS-LS1-3, HS-LS1-4, HS-LS2-1, HS-LS2-2, HS-LS2-3, HS-LS2-4, HS-LS2-5, HS-LS2-6, HS-LS2-7</p>		

Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>17. Student demonstrates understanding of how competition and cooperation are important aspects of biological systems.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. explains how interactions between molecules affect their structure and function.</li> <li>b. explains how cooperative interactions within organisms promotes efficiency in the use of energy and matter.</li> <li>c. explains how interactions between and within populations influence patterns of species distribution and abundancies.</li> </ul>	<ul style="list-style-type: none"> <li>• Quizzes and tests</li> <li>• Projects</li> <li>• Research</li> <li>• Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>• AP Lab 10 Energy Dynamics</li> <li>• AP Lab 11 Transpiration</li> <li>• AP Lab 12 Fruit Fly Behavior</li> <li>• AP Lab 13 Enzyme Activity</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>• Lab 2 Enzyme Catalysis</li> <li>• Lab 9 Transpiration</li> <li>• Lab 10 Physiology of the Circulatory System</li> <li>• Lab 11 Animal Behavior</li> <li>• Lab 12 Dissolved Oxygen and Aquatic Primary Productivity</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS1-1, HS-LS1-2, HS-LS1-3, HS-LS2-1, HS-LS2-2, HS-LS2-6, HS-LS2-7, HS-LS2-8</p>		



Essential Learning Objectives	Performance Indicators	Classroom Assessments
<p><b>18. Student demonstrates understanding of how naturally occurring diversity among and between components within biological systems affects interactions with the environment.</b></p>	<p><b>Performance will be satisfactory when the student:</b></p> <ul style="list-style-type: none"> <li>a. explains how variation in molecular units provides cells with a wider range of functions (4.C.1).</li> <li>b. explains how environmental factors influence the expression of the genotype in an organism (4.C.2).</li> <li>c. explains how the level of variation in a population affects population dynamics (4.C.3).</li> <li>d. understands how the diversity of species within an ecosystem may influence the stability of the ecosystem (4.C.4).</li> </ul>	<ul style="list-style-type: none"> <li>• Quizzes and tests</li> <li>• Projects</li> <li>• Research</li> <li>• Performance assessment</li> </ul> <p><u>AP Biology Inquiry Labs</u></p> <ul style="list-style-type: none"> <li>• AP Lab 10 Energy Dynamics</li> <li>• AP Lab 11 Transpiration</li> <li>• AP Lab 12 Fruit Fly Behavior</li> <li>• AP Lab 13 Enzyme Activity</li> </ul> <p><u>AP Biology Lab Manual</u></p> <ul style="list-style-type: none"> <li>• Lab 2 Enzyme Catalysis</li> <li>• Lab 9 Transpiration</li> <li>• Lab 10 Physiology of the Circulatory System</li> <li>• Lab 11 Animal Behavior</li> <li>• Lab 12 Dissolved Oxygen and Aquatic Primary Productivity</li> </ul>
<p><b>Objectives are linked to the following AASD Next Generation Science Standards:</b></p> <p>HS-LS1-1, HS-LS1-2, HS-LS1-3, HS-LS3-2, HS-LS3-3, HS-LS4-6, HS-LS2-6, HS-LS2-7</p>		

## College Board AP Biology Curriculum Framework

[http://media.collegeboard.com/digitalServices/pdf/ap/10b\\_2727\\_AP\\_Biology\\_CF\\_WEB\\_110128.pdf](http://media.collegeboard.com/digitalServices/pdf/ap/10b_2727_AP_Biology_CF_WEB_110128.pdf)