East Penn School District
Curriculum and Instruction

Curriculum for: Biology 1, Applied/CP/Honors

Course(s): Biology 1

Grades: 9 and 10

Department: Science

Length of Period (average minutes): 42

Periods per cycle: 8

Length of Course (yrs): 1

Type of offering: requirement

Credit(s) awarded: 1.4 App/CP 4.0/4.0
H 4.5/4.0

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ADOPTED: 2018

Enduring Understandings & Essential Questions	Knowledge	Skills	Standards
Enduring Understandings: ● The process of science helps biologists investigate how nature works at all levels, from the molecules in cells to the biosphere. Essential Questions: ● What role does science play in the study of life?	● How we find explanations for events in the natural world ● How the scientific community and society influence the process of science ● The definition of biology ● The characteristics of living things ● Technological advances have influenced the progress of science and science has influenced advances in technology. (HS-LS3-3) ● Science and engineering are influenced by society and society is influenced by science and engineering. (HS-LS3-3) ● LS1.A: Structure and Function	● Learn how to use scientific methodology to plan and carry out scientific investigations ● Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.	NGSS Standards: ● HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. ● LS1.A: Structure and Function - Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) - Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. (HS-LS1-2) - Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3) ● LS1.A: Structure and Function All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins.
Enduring Understandings: ● A cell is the basic unit of life; the processes	● How organisms store energy (difference in relative amounts of	● Use models to demonstrate how energy is converted and transferred during the	NGSS Standards: ● HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

that occur at the cellular level provide the energy and basic structure organisms need to survive. Essential Questions: ● How do plants and other organisms capture energy from the sun? ● How do organisms obtain energy?	stored energy in bonds of reactants vs. products) ● What cellular structures and molecules are involved in photosynthesis ● How photosynthetic organisms convert the sun's energy into chemical energy ● Why organisms undergo the process of cellular respiration ● How cells release energy from food in the presence of oxygen ● How cells release energy from food without oxygen ● LS1.C: Organization for Matter and Energy Flow in Organisms ● LS2.B: Cycles of Matter and Energy Transfer in Ecosystems ● PS3.D: Energy in Chemical Processes	process of photosynthesis. ● Use analogies to understand the function of ATP and electron carriers. ● Use mathematics to account for the energy produced during the breakdown of glucose. ● Use data analysis skills by collecting and interpreting data on the byproducts of cellular respiration and/or photosynthesis.	● 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. Energy and Matter - Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. ● 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.
Enduring Understandings: ● A cell is the basic unit of life; the processes that occur at the cellular level provide the energy and basic structure organisms need to survive.	● How cells divide ● Why cells divide ● How a cell controls the process of cell division ● How a single undifferentiated cell leads to a complex multicellular organism	● Construct and use models to demonstrate how cells grow and divide during the cell cycle ● Apply their knowledge of cell regulation and differentiation by creating real-world	NGSS Standards: ● HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. ● 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

Essential Questions: ● How does a cell produce a new cell?	● LS1.B: Growth and Development of Organisms	analogies for both processes	during replication, and/or (3) mutations caused by environmental factors.
Enduring Understandings: ● A cell is the basic unit of life; the processes that occur at the cellular level provide the energy and basic structure organisms need to survive. Essential Questions: ● How are cell structures adapted to their functions?	● Why it is important to study cells ● How cell structures enable a cell to carry out basic life processes ● How a cell transports materials across the cell membrane ● How a cell maintains homeostasis both within itself and as part of a multicellular organism	● Use models and analogies to learn about the structure and function of cells ● Evaluate different feedback mechanisms that organisms use to maintain homeostasis. ● Explain how the function of organelles responsible for living processes is dependent upon their structure.	NGSS Standards: ● HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. ● LS1.A: Structure and Function - Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1) - Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3) Stability and Change - Feedback (negative or positive) can stabilize or destabilize a system. (HS-LS1-3)
Enduring Understandings: ● The existence of life on Earth depends on interactions among organisms and between organisms and their environment.	● Ecology is the study of biotic and abiotic relationships ● How different organisms get the energy they need to survive ● How energy moves through an ecosystem	● Tabulate processes in natural cycles of matter and evaluate the relationship of those processes in an ecosystem ● Synthesize content to display understanding of the movement of matter	NGSS Standards: ● HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. ● LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

Essential Questions: ● How do living and nonliving parts of Earth interact and affect the survival of organisms? ● How do abiotic and biotic factors shape ecosystems? ● What factors contribute to changes in populations? Honors (in addition to the above): ● How have human activities shaped local and global ecology?	● Why the cycling of matter is important to life on Earth ● What factors affect global climate ● How organisms interact with one another ● How ecosystems change over time ● The characteristics of the major biomes and aquatic ecosystems ● How populations grow ● What factors limit a population's growth ● How the human population is growing Honors (in addition to the above): ● How human activity affects the environment ● How we can use natural resources wisely ● Why it is important to protect and conserve biodiversity ● How we can change our behaviors to help protect our planet	and energy in ecosystems ● Use the concept of competition to explain how related species can survive in the same habitat ● Demonstrate their knowledge of ecosystems and communities by analyzing data, interpreting data and graphs, and describing phenomena such as competition and succession ● Use quantitative thinking and construct models to show how growth patterns for populations can vary Honors (in addition to the above): ● Ask questions about, and identify, the effects of different agricultural practices on humans and on ecosystems ● Interpret information in maps, graphs, and diagrams related to content	- Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. - Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. ● LS2.A: Interdependent Relationships in Ecosystems - Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the

			abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1),(HS-LS2-2) ● 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. ● PS3.D: Energy in Chemical Processes The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. ● 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-LS2-6. 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. ● LS2.C: Ecosystem Dynamics, Functioning, and Resilience - A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in

			conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. ● LS4.D: Biodiversity and Humans - Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). (secondary to HS-LS2-7) - Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary to HS-LS2-7),(HS-LS4-6.)
Enduring Understandings: ● DNA is the universal code for life; it enables an organism to transmit hereditary information and, along with the environment, determines an organism's characteristics.	● How an organism passes its characteristics onto its offspring ● How you can predict the outcome of a genetic cross ● How interactions between alleles, genes, and the environment can affect an organism's traits ● How a cell divides to create cells with exactly	● Use mathematics and computational thinking to analyze patterns of inheritance ● Use critical thinking skills to synthesize knowledge of meiosis, patterns of inheritance, and gene linkage ● Explain how the functions of the DNA molecule are made	NGSS Standards: ● HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells. ● LS1.A: Structure and Function - All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out

Essential Questions: ● How does cellular information pass from one generation to the next? ● What is the structure of DNA and how does it function in genetic inheritance? ● How does information flow from the cell nucleus to direct the synthesis of proteins in the cytoplasm? ● How can we use genetics to study human inheritance?	half of the original cell's genetic information ● How scientists determine that DNA is responsible for storing, copying, and transmitting genetic information ● How the basic structure of DNA was discovered ● How cells copy their DNA ● What RNA is ● How cells make proteins ● What happens when a cell's DNA changes ● How cells regulate gene expression ● How studying the human genome helps us draw conclusions about the inheritance of traits ● What causes some human genetic disorders ● How we study the human genome to learn more	possible by its unique structure ● Explain the effects of transcription and translation on gene expression ● Analyze data, interpret diagrams, and use analogies to develop an understanding of how the information in DNA is used to direct protein synthesis and influence an organism's characteristics ● Construct a model to demonstrate the pattern of inheritance for a recessive human gene	most of the work of cells. (HS-LS1-1) (Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.) ● HS-LS3-1. Ask questions to clarify relationships 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. ● LS3.A: Inheritance of Traits - Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)
Enduring Understandings: ● There are chemical principles that underlie life processes from	● What is the matter in organisms made of ● Why the properties of water are important to organisms	● Use models to visualize how the structure of life's molecules connect to their function ● Use diagrams, lab activities, and analogies	NGSS Standards: ● PS1.A: Structure and Properties of Matter Each atom has a charged substructure consisting of a nucleus, which is made of

atoms, to enzymes, to the biosphere. Essential Questions: ● What are the basic chemical principles that affect living things?	● How do organisms use different types of carbon compounds ● How chemicals combine and break apart inside living things	to learn about the chemistry of life	protons and neutrons, surrounded by electrons. (HS-PS1-1) ● 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 the temperature or concentration ● 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. ● LS1.C: Organization for Matter and Energy Flow in Organisms - The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. - As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products.
Enduring Understandings: ● The diversity of life is the result of ongoing evolutionary change. Species alive today have evolved from	● The patterns of diversity Darwin observed while traveling aboard the Beagle ● How other scientists' work helped Darwin	● Communicate information to explain several mechanisms that drive evolutionary change ● Interpret visuals, analyze data and apply	NGSS Standards: ● 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.

ancient common ancestors. Essential Questions: ● What is natural selection? ● How can populations evolve to form new species?	develop his theory of natural selection ● Darwin's theory of evolution by natural selection ● The main lines of scientific evidence that support Darwin's theory of evolution by natural selection ● How genes make evolution possible ● What causes a population's gene pool to change ● How new species form ● What genes can tell us about an organism's evolutionary history	concepts to demonstrate comprehension that the diversity of life is the result of ongoing evolutionary change ● Communicate information to demonstrate their understanding of how populations change ● Use models, graphs and data to learn how changes in allele frequencies lead to speciation	● HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations. contribute to a change in gene frequency over time, leading 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. ● LS4.C: Adaptation - Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (HS-LS4-6)

Materials and Resources:
Textbook:

- Miller, Kenneth R., and Joseph S. Levine. *Miller & Levine Biology*. Boston, MA: Pearson, 2014. Print. https://www.pearsonsuccessnet.com
- Teacher selected resources