Haddon Township High School
Course Overview

Subject Area: Science
Course Name: Lab Biology

Summary: Biology is the study of living organisms, their origins, how they survive, reproduce, change over time, and interact with each other and their environments. The primary objective of Lab Biology is to provide students with a fundamental understanding of modern biology and scientific processes. Lab Biology will prepare students for upper level and college Biology classes.

Unit Title	Student Learning Target	Standards	Resources	Assessment
Science Practices/Scientific Method and Measurement	• Develop an understanding of the relationships among facts, concepts, principles, theories and models; then • Use the above relationships to understand and interpret phenomena in the natural world. • Construct and refine explanations, arguments or models of the natural world through the use of quantitative and qualitative evidence and data. • Understand that data differs in quality and strength of explanatory power based on experimental design • Evaluate the strength of scientific arguments based on the quality of the data and the evidence presented	5.1: All students will understand that science is a both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.	solutions, glassware, metric measuring tools, beans, yeast, balloons, sugar solution, microscopes, ring stands, clamps, string, pendulum masses/bobs, stopwatches	Labs…Seed germination, Brine shrimp, Pendulum, Metric Station Unit Test

	• Ask a question and decide what to measure in order to answer the question. • Develop strategies for obtaining measurements then systematically collecting data • Use mathematics in the collection and treatment of data and in the reasoning used to develop concepts, laws and theories • Using tools of data analysis to organize data and formulate hypothesis for further testing • Explain the reasoning behind a proposed claim while citing evidence. • Represent and describe mathematical relationships among variables using graphs and tables • Use mathematical tools to construct and evaluate claims. • Revise predictions or explanations on the basis of seeing new data and evidence • Use data and evidence to modify and extend investigations • Understand that explanations are increasingly valuable as			

	they account for the available evidence more completely. • Interact with others to test new ideas, soliciting and providing feedback, articulating emerging explanations, developing, shared representations and models and reaching consensus • Develop a sense of appropriate trust and skepticism when evaluating others' claims, evidence and reasoning • Construct literal representations from empirical evidence and observations • Present and defend a scientific argument using literal representations • Evaluate others' literal representations for consistency with their claims, evidence and reasoning • Move fluently between representations such as graphs, data, equations, diagrams, and verbal explanations • Select and use appropriate instrumentation to design and conduct investigations • Evaluate and practice			

	safe procedures for conducting science investigations • Demonstrate appropriate digital citizenship when assessing scientific data from collaborative spaces • Ensure that living organisms are properly cared for and treated humanely, responsibly and ethically.			
Biochemistry	• Model the four major categories of organic molecules (proteins, lipids, carbohydrates and nucleic acids) using unique characteristics and primary functions. • Determine how and why each major category of organic molecule is essential to life. • Identify the six elements most common to biological organisms: carbon, hydrogen, oxygen, nitrogen, phosphorus and sulfur • Analyze and explain how cells carry out a variety of chemical transformations that allow the conversions of energy from one form to another, the breakdown of molecules into smaller units, and the building of	5.3: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics. 9.1: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.	chemicals specific to each lab activity, glassware, balances	Labs… Chemical Inquiry Lab, Water Lab, Buffer Lab, Enzyme Lab, Acid Rain Lab, Testing for Organic Compounds Lab. Unit Test

	large molecules from smaller ones. • Describe how most chemical transformations are made possible by protein catalysts called enzymes. • Identify enzymes as proteins, and determine how they catalyze biochemical reactions. Conduct experiments to demonstrate that the activities of enzymes are affected by the temperature, ionic conditions, and the pH of the surroundings.			
Cells and Cell Structure	• Model how processes are regulated both internally and externally by environments in which cells exist. • Explain how the fundamental life processes of organisms depend on a variety of chemical reactions that occur in specialized areas of the organism's cells. • Model how cells are enclosed within semi-permeable membranes that regulate their interaction with their surroundings including the transport of materials into and out of the cell. • Describe how	5.3: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics. 9.1: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global	computer lab & projection system, beakers, eggs, corn syrup, distilled water, lab packets	Labs…Set of 4 Osmosis labs Unit Test

	advancements in technology mirror advancements in understanding the structure of cells. • Explain the cell theory. • Compare prokaryotic and eukaryotic cells; animal and plant cells. Describe the structure and function of the various cell organelles.	citizens and workers in diverse ethnic and organizational cultures.		
Cell Reproduction and Differentiation	• Explain how the many cells in an individual can be very different from one another, even though they are all descended from a single cell and thus have essentially identical genetic instructions • Trace the general process where the progeny from a single cell form an embryo in which the cells multiply and differentiate to form the many specialized cells, tissues and organs that comprise the final organism • Present evidence that supports the concept that complex multicellular organisms are formed as a highly	5.3: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics. 9.1: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.	microscopes, microscope slides, drawing paper, glue, lab packets	Labs…Cell Cycle Lab, Crossing Over Lab Unit Test

	organized arrangement of differentiated cells • Provide examples of how different parts of the genetic instructions are influenced by the cell's environment • Identify genes as a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism • Relate the specialization of cells in multicellular organisms to the different patterns of gene expression rather than to differences of the genes themselves • Apply these understandings to analyze, support and/or critique current and emerging biotechnologies • Describe the relationships within multi-cellular organisms, where cells perform specialized functions			

	as parts of sub-systems (e.g., tissues, organs, and organ systems), which work together to maintain optimum conditions for the benefit of the whole organism • Describe why certain chemicals, pathogens, and high-energy radiation can seriously impair normal cell functions and the health of the organism • Identify emerging biotechnology that shows promise in preventing and treating disease			
Heredity and Reproduction	Explain how the instructions for specifying the characteristics of the organism are carried in DNA, a large polymer formed from subunits of four kinds (adenine, thymine, guanine, and cytosine) • Explain how the chemical and structural properties of DNA allow for genetic information to be both encoded in genes and replicated • Identify that hereditary information is contained in	5.3: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics. 9.1: All students will demonstrate the creative,	lab packets, chemicals and lab apparatus for lab activities mentioned to the right	Labs: Protein Synthesis, Mutations, Plasmid, DNA Fingerprint Unit Test

	genes, located in the chromosomes of each cell, and each gene carries a single unit of information • Provide specific examples of how an inherited trait of an individual can be determined by one or many genes and a single gene can influence more than one trait • Analyze the current and potential impact of genome projects on human health (e.g. pathogenic bacteria or disease vectors) or species with commercial importance (e.g. livestock and crop plants). Explain that changes in DNA (mutations) occur spontaneously at low rates, and some of these changes make no difference to the organism, whereas others can change cells and organisms • Explain that only mutations in germ cells can create the variation that changes an organism's offspring • Trace the progression of conditions that result from genetic mutation in a variety of different	critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.		

	organisms • Explain the process where an egg and sperm unite to begin the development of a new individual, and how that new individual receives genetic information from its parents • Explain how sexually produced offspring are never identical to either of their parents • Describe how new heritable characteristics can result from new combinations of existing genes in reproductive cells • Describe how heritable characteristics can strongly influence what capabilities an organism will have, therefore influencing how likely it is to survive and reproduce			
Evolution and Diversity	• Explain how heritable characteristics can strongly influence how likely an individual is to survive and reproduce. • Describe how evolution involves changes in the genetic make-up of whole populations over time, not changes in the genes of an individual organisms	5.3: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled	lab packets, calculators	Labs- Natural Selection Lab, Hardy Weinberg Lab Unit Test

	• Analyze natural selection simulations and use the data generated to describe how environmentally favored traits are perpetuated over generations resulting in species survival, while less favorable traits decrease in frequency or may lead to extinction. • Identify, explain and demonstrate how technology can be used to determine evolutionary relationships among species (gel electrophoresis, DNA/amino acid sequences) • Integrate scientific information from a variety of disciplines to provide evidence for the relatedness of species n Earth (geology, comparative anatomy, biochemistry, and taxonomy) • Acknowledge that a change in species over time does not follow a set pattern or time line • Explain, using evidence, how millions of different species on Earth today are related by common ancestry	and predicted through the use of mathematics. 9.1: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.		

	• Use natural selection and its evolutionary consequences to provide a scientific explanation for the fossil record of ancient life forms, and the molecular similarities observed among the diverse species of living organisms • Discuss how environmental pressure, genetic drift, mutation and competition for resources influence the evolutionary process • Predict possible evolutionary implications for a population due to environmental changes over time (e.g., volcanic eruptions, global climate change, pollution)			
Ecology: Interdependence	• Analyze the interactions between organisms that result from the ability to produce populations of infinite size in an environment where resources are finite. • Provide evidence of how organisms both cooperate and compete in ecosystems • Use evidence to explain why interrelationships and interdependencies of organisms may generate stable ecosystems.	5.3: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics. 9.1: All students will demonstrate the creative,	lab packets, computers, calculators, graph paper	Lab…Population Lab Unit Test

	• Identify situations where humans intentionally and unintentionally modify ecosystems as a result of population growth, technology, and consumption. • Provide evidence of how human destruction of habitats threatens current local and global ecosystem stability. • Predict how direct harvesting, pollution, atmospheric changes, and other factors will affect population dynamics in a given ecosystem based on data and accepted mathematical models. • Predict how natural disasters such as hurricanes, floods, volcanoes will affect population dynamics of a given ecosystem based on data and accepted mathematical models.	critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.		
Ecology: Matter and Energy Transformation	• Trace the cycling of atoms and molecules on earth among the living and nonliving components of the biosphere. • Explain how molecules are used to assemble larger molecules with biological activity	5.3: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that	lab packets, grow lights, seeds, water, beakers, metric rulers, balances, drawing paper, colored pencils, computers	Labs…Seed respiration , food webs, bio-magnification Unit Test

	(including proteins, DNA, sugars and fats) • Follow the transfer of matter (molecules) from one organism to another repeatedly and between organisms and their physical environment. • Identify how the total amount of matter in a system remains constant, even though its form and location change • Explain how food webs are limited and how pyramidal relationships exist. • Recognize that all matter tends toward more disorganized states and that living systems require a continuous input of energy to maintain their chemical and physical organizations. • Recognize that the chemical bonds of food molecules contain energy, which is released when the bonds of food molecules are broken and new compounds with lower energy bonds are formed • Calculate the trends in production, use and transfer of energy from one trophic level to	govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics. 9.1: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.		

	another using data. • Trace the path that energy entering ecosystems as sunlight follows when being transferred by producers into chemical energy through photosynthesis, and then being passed from organism to organism through food webs. • Explain that living systems require a continuous input of energy to maintain their chemical and physical organizations and also that with death (the cessation of energy input), living systems rapidly disintegrate. • Describe the process of photosynthesis as providing a vital connection between the sun and the energy needs of living systems. • Describe how plants capture energy by absorbing light and use it to form strong chemical bonds between the atoms of carbon molecules. • Design independent investigations to determine the effects of changing environmental			

	factors on photosynthesis • Analyze and describe how the process of photosynthesis provides a vital connection between the sun and the energy needs of living systems. • Explain how plants and many microorganisms use solar energy to combine molecules of carbon dioxide and water into complex, energy rich compounds and release oxygen to the environment. • Explain how the breakdown of some food molecules enables the cell to store energy in specific molecules that are used to carry out the many functions of the cell • Trace the process in which nutrients are transported to cells to serve as building blocks for the synthesis of structures and as reactants for cellular respiration • Explain how food molecules are taken into cells and react to provide the chemical constituents needed to synthesize other molecules, and that			

	the breakdown and synthesis are made possible by enzymes.			