Haddon Township High School
Course Overview Template

Subject Area: Science
Course Name: Applied Biology

Summary: Applied Biology involves a study of cell biology, cancer, genetics, evolution, and ecology. Concepts under examination will involve the differences between normal and abnormal functioning. This course will emphasize lab work and related analyses of lab activities.

Unit Title	Student Learning Target	Standards	Resources	Assessment
Biology Basics – Tools of a Scientist	*Students will ...* • Ask a question and decide what to measure in order to answer the question. • Develop strategies for obtaining measurements then systematically collecting data • Gather data, then interpret and evaluate the data. • Use the empirical results to determine causal/correlational relationships. • Use tools of data analysis to organize data and formulate hypothesis for further testing • Make claims based on available evidence. • Explain the reasoning, citing evidence, behind a proposed claim. • Interact with others to test new ideas, soliciting and providing feedback, articulating emerging	5.1 Science Practices: Science is 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. 9.1 21st Century Life and Career Skills: 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.	Textbook, solutions, glassware, metric measuring tools, beans, yeast, balloons, sugar solution, microscopes, lab papers	Laboratory activity – Are the two unknown solutions the same? Laboratory activity – Why measure a bean? Laboratory activity – Yeast? What is it – biotic or abiotic?

	explanations, developing shared representations and models and reaching consensus. • Select and use appropriate tools to design and conduct investigations. • Practice safe procedures for conducting science investigations.			
Ecology: Matter and Energy Transformation	*Students will ...* • Trace the cycling of atoms and molecules on earth among the living and nonliving components of the biosphere. • 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	5.3 Life Science: 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 21st Century Life and Career Skills: 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.	Textbook, Internet, poster & art supplies, text books, computer visuals, beans, china markers, envelopes, activity packets	Ecosystem posters and presentations Food chain & web guided learning/discovery packets Biome guided learning/discovery packet Carrying capacity and population count mini-activities (mark & recapture, random sampling)

	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 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. • Recognize that living systems require a continuous input of energy to maintain their chemical and physical organizations and also understanding that with death (the cessation of energy input), living systems rapidly disintegrate.			

	• Recognize the process of photosynthesis as providing a vital connection between the sun and the energy needs of living systems. • 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.			
Ecology Interdependence	*Students will …* • 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	**5.3 Life Science**: 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	Textbook, Internet access, elodea, feeder fish, bromothymol blue, fish tank, baby food jars w/lids, discovery packet, acid rain, simulated and real lake water	Analyze data from documentary on man's interference in nature and form conclusions. Summary focusing on carbon cycle & water cycle interference. Photosynthesis-cell respiration (fish/plant) lab Biome self-guided discovery packet Lab, Acid rain in the lakes

	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 in a given ecosystem based on data and accepted mathematical models. • Describe how plants capture energy by absorbing light and use it to form strong chemical bonds between the atoms of carbon containing 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	mathematics. 9.1 21st Century Life and Career Skills: 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		

	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 Recognize that food molecules are taken into cells and react to provide the chemical constituents needed to synthesize other molecules, and knowing that the breakdown and synthesis are made possible by enzymes.			
Biochemistry	Unit Learning Targets *Students will ...* • 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	5.2 Physical Science: All students will understand that physical science principles, including fundamental ideas about matter, energy, and motion, are powerful conceptual tools for making sense of phenomena in physical, living, and Earth systems science.	Textbook, Internet access, potatoes, hot plates, pots, glassware, hydrogen peroxide, model building kits, organic food samples, benedicts solution, Biuret solution, Lugol's iodine solution, lunch bags, paper clips	Laboratory activity – Chemical reactions (Enzymes & pH) lab – Catalase enzymes in potatoes Model building – Ionic & covalent bonds Laboratory activity – Organic compounds in food

	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 large molecules from smaller ones. • Recognize that 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. • Write chemical equations for chemical reactions and diagram the bonds that form in the compounds that result.	5.3 Life Science: 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 21st Century Life and Career Skills: 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.		lab Laboratory activity – Polar covalent molecules (water activity)

Cells – Structure & Function	*Students will ...* • Model how processes are regulated both internally and externally by the environment 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. • Explain the cell theory • Compare prokaryotic and eukaryotic cells; animal and plant cells. • Describe the structure and function of the various cell organelles. • Contrast the cellular growth of an organism to the cellular specialization of an organism • Explain how the malfunctioning of the cell cycle can develop into cancer	5.3 Life Science: 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 21st Century Life and Career Skills: 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.	Textbook, Internet access, computer & projection system, beakers, eggs, corn syrup, distilled water, lab packets, cancer unit/kit	Power Point presentation on cell organelle or part Laboratory activity – cells in solution (egg lab) Lab activity – chicken egg lab & cell differentiation Cancer article and conclusion summary

Molecular Genetics	*Students will ...* • 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 multi-cellular 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 • Recognize that 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)	5.3 Life Science: 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 21st Century Life and Career Skills: 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.	Textbook, Internet access, embryo puzzle pieces, embryo charts/poster, construction paper, scissors, glue	Lab activity – embryo development poster/chart/puzzle Computer lab – DNA – "tour of the basics" internet activity Computer lab – Protein synthesis internet activity Lab activity – Down syndrome karyotype & analysis Lab activity – sickle cell anemia gene activity Lab activity – Who Killed Rockina – DNA fingerprint analysis

	• 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 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) • Recognize 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 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 • Understand how new heritable characteristics can			

	result from new combinations of existing genes in reproductive cells • Recognize 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	*Students will ...* • Recognize 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 • 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	**5.3 Life Science**: 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 21st Century Life and Career Skills: All students will demonstrate the creative, critical thinking, collaboration, and problem-solving skills	computer, lab packets/pages	Computer lab - natural selection & the peppered moths Lab Activity – analyzing amino acid sequences to determine evolutionary relationships

	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 on Earth (geology, comparative anatomy, biochemistry, and taxonomy) • Recognize that a change in species over time does not follow a set pattern or time line • Explain how millions of different species on Earth today are related by common ancestry using evidence • 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	needed to function successfully as both global citizens and workers in diverse ethnic and organizational cultures.		

	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)			