

TENNESSEE/METRO NASHVILLE PUBLIC SCHOOLS ACADEMIC STANDARDS/SCIENCE - BIOLOGY II

BIOLOGY II: EMBEDDED INQUIRY

Conceptual Strand - Inquiry <i>Understandings about scientific inquiry and the ability to conduct inquiry are essential for living in the 21st century.</i>		Guiding Question - Inquiry <i>What tools, skills, knowledge, and dispositions are needed to conduct scientific inquiry?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3216.Inq.1 Recognize that science is a progressive endeavor that reevaluates and extends what is already accepted.</p> <p>CLE 3216.Inq.2 Design and conduct scientific investigations to explore new phenomena, verify previous results, test how well a theory predicts, and compare opposing theories.</p> <p>CLE 3216.Inq.3 Use appropriate tools and technology to collect precise and accurate data.</p> <p>CLE 3216.Inq.4 Apply qualitative and quantitative measures to analyze data and draw conclusions that are free of bias.</p> <p>CLE 3216.Inq.5 Compare experimental evidence and conclusions with those drawn by others about the same testable question.</p> <p>CLE 3216.Inq.6 Communicate and defend scientific findings.</p>	<p>3216.Inq.1 Trace the historical development of a scientific principle or theory, such as cell theory, evolution, or DNA structure.</p> <p>3216.Inq.2 Conduct scientific investigations that include testable questions, verifiable hypotheses, and appropriate variables to explore new phenomena or verify the experimental results of others.</p> <p>3216.Inq.3 Analyze the components of a properly designed scientific investigation.</p> <p>3216.Inq.4 Select appropriate tools and technology to collect precise and accurate quantitative and qualitative data.</p> <p>3216.Inq.5 Determine if data supports or contradicts a hypothesis or conclusion.</p> <p>3216.Inq.6 Recognize, analyze, and evaluate alternative explanations for the same set of observations.</p> <p>3216.Inq.7 Evaluate the accuracy and precision of data.</p> <p>3216.Inq.8 Defend a conclusion based on scientific evidence.</p> <p>3216.Inq.9 Determine why a conclusion is free of bias.</p> <p>3216.Inq.10 Analyze experimental results and identify possible sources of experimental error.</p> <p>3216.Inq.11 Formulate and revise scientific explanations and models using logic and evidence.</p> <p>3216.Inq.12 Compare conclusions that offer different, but acceptable explanations for the same set of experimental data.</p>	

EMBEDDED TECHNOLOGY & ENGINEERING

Conceptual Strand <i>Society benefits when engineers apply scientific discoveries to design materials and processes that develop into enabling technologies.</i>		Guiding Question <i>How do science concepts, engineering skills, and applications of technology improve the quality of life?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3216.T/E.1 Explore the impact of technology on social, political, and economic systems.</p> <p>CLE 3216.T/E.2 Differentiate among elements of the engineering design cycle: design constraints, model building, testing, evaluating, modifying, and retesting.</p> <p>CLE 3216.T/E.3 Explain the relationship between the properties of a material and the use of the material in the application of a technology.</p> <p>CLE 3216.T/E.4 Describe the dynamic interplay among science, technology, and engineering within living, earth-space, and physical systems.</p>	<p>3216.T/E.1 Distinguish among tools and procedures best suited to conduct a specified scientific inquiry.</p> <p>3216.T/E.2 Apply the engineering design process to construct a prototype that meets developmentally appropriate specifications.</p> <p>3216.T/E.3 Evaluate a protocol to determine the degree to which an engineering design process was successfully applied.</p> <p>3216.T/E.4 Explore how the unintended consequences of new technologies can impact human and non-human communities.</p> <p>3216.T/E.5 Evaluate the overall benefit to cost ratio of a new technology.</p> <p>3216.T/E.6 Present research on current bioengineering technologies that advance health and contribute to improvements in our daily lives.</p> <p>3216.T/E.7 Design a series of multi-view drawings that can be used by other students to construct an adaptive design and test its effectiveness.</p>	

EMBEDDED MATHEMATICS

Conceptual Strand <i>Science applies mathematics to investigate questions, solve problems, and communicate findings.</i>		Guiding Question <i>What mathematical skills and understandings are needed to successfully investigate biological topics?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3216.Math.1 Understand the mathematical principles associated with the science of biology.</p> <p>CLE 3216.Math.2 Utilize appropriate mathematical equations and processes to understand biological concepts.</p>	<p>3216.Math.1 Choose, construct, and analyze appropriate graphical representations for a data set.</p> <p>3216.Math.2 Analyze graphs to interpret biological events.</p> <p>3216.Math.3 Make decisions about units, scales, and measurement tools that are appropriate for problem situations involving measurement.</p> <p>3216.Math.4 Select and apply an appropriate method to evaluate the reasonableness of results.</p> <p>3216.Math.5 Apply and interpret rates of change from graphical and numerical data.</p> <p>3216.Math.6 Apply geometric properties, formulas, and relationships to interpret biological phenomena.</p> <p>3216.Math.7 Use length, area, and volume to estimate and explain real-world problems.</p> <p>3216.Math.8 Make predictions from a linear data set using a line of best fit.</p> <p>3216.Math.9 Interpret a set of data using the appropriate measure of central tendency.</p>	

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STANDARD 1 – CELLS

Conceptual Strand 1 <i>All living things are made of cells that perform functions necessary for life.</i>		Guiding Question 1 <i>How are plant and animals cells organized to carry on the processes of life?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3216.1.1 Compare the characteristics of prokaryotic and eukaryotic cells.</p> <p>CLE 3216.1.2 Describe how fundamental life processes depend on chemical reactions that occur in specialized parts of the cell.</p> <p>CLE 3216.1.3 Explain how materials move into and out of cells.</p> <p>CLE 3216.1.4 Describe the enzyme-substrate relationship.</p> <p>CLE 3216.1.5 Investigate how proteins regulate the internal environment of a cell through communication and transport.</p> <p>CLE 3216.1.6 Describe the relationship between viruses and their host cells.</p>	<p>3216.1.1 Compare the organization and function of prokaryotic and eukaryotic cells.</p> <p>3216.1.2 Conduct an experiment or simulation to demonstrate the movement of molecules through diffusion, facilitated diffusion, and active transport.</p> <p>3216.1.3 Describe the composition and function of enzymes.</p> <p>3216.1.4 Analyze the rate of reactions in which variables such as temperature, pH, and substrate and enzyme concentration are manipulated.</p> <p>3216.1.5 Develop a flow chart that tracks a protein molecule from transcription through export from the cell.</p> <p>3216.1.6 Describe the role of the ribosomes, endoplasmic reticulum, and Golgi apparatus in the production and packaging of proteins.</p> <p>3216.1.7 Describe how carbohydrates, proteins, lipids, and nucleic acids function in the cell.</p> <p>3216.1.8 Illustrate the interactions between a virus and a host cell.</p>	

STANDARD 2— INTERDEPENDENCE

Conceptual Strand 2 <i>All life is interdependent and interacts with the environment.</i>		Guiding Question 2 <i>How do living things interact with one another and with the non-living elements of their environment?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3216.2.1 Describe how the stability of an ecosystem is maintained.</p> <p>CLE 3216.2.2 Investigate the major factors that influence population size and age distribution.</p> <p>CLE 3216.2.3 Describe the varying degrees to which individual organisms are able to accommodate changes in the environment.</p> <p>CLE 3216.2.4 Distinguish between the accommodation of individual organisms and the adaptation of a population to environmental change.</p>	<p>3216.2.1 Analyze the ecological impact of a change in climate, human activity, introduction of non-native species, and changes in population size over time.</p> <p>3216.2.2 Investigate how fluctuations in population size in an ecosystem are determined by the relative rates of birth, death, immigration, and emigration.</p> <p>3216.2.3 Investigate how human changes to the environment have led populations to adapt, migrate, or become extinct.</p> <p>3216.2.4 Contrast accommodations of individual organisms with the adaptation of a species.</p>	

STANDARD 3—FLOW OF MATTER AND ENERGY

Conceptual Strand 3 <i>Matter and energy flow through the biosphere.</i>		Guiding Question 3 <i>What scientific information explains how matter and energy flow through the biosphere?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3216.3.1 Describe the role of biotic and abiotic factors in the cycling of matter in the ecosystem.</p> <p>CLE 3216.3.2 Explain how sunlight is captured by plant cells and converted into usable energy.</p> <p>CLE 3216.3.3 Describe how mitochondria make stored chemical energy available to cells.</p> <p>CLE 3216.3.4 Examine how macromolecules are synthesized from simple precursor molecules.</p> <p>CLE 3216.3.5 Analyze the role of ATP in the storage and release of cellular energy.</p>	<p>3216.3.1 Describe how water, carbon, oxygen, and nitrogen cycle between the biotic and abiotic elements of the environment.</p> <p>3216.3.2 Calculate the amount of energy transfer through an ecosystem.</p> <p>3216.3.3 Design an experiment to separate plant leaf pigments.</p> <p>3216.3.4 Develop a concept map or flow chart to compare the sequence of molecular events during photosynthesis and cellular respiration.</p> <p>3216.3.5 Sequence the steps involved in sugar production during photosynthesis.</p> <p>3216.3.6 Trace the breakdown of sugar molecules during cellular respiration.</p> <p>3216.3.7 Compare the amount of ATP produced during aerobic and anaerobic respiration.</p> <p>3216.3.8 Build models of macromolecules from simple precursors.</p>	

STANDARD 4—HEREDITY

Conceptual Strand 4 <i>Organisms reproduce and transmit hereditary information.</i>		Guiding Question 4 <i>What are the principal mechanisms by which living things reproduce and transmit information between parents and offspring?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3216.4.1 Describe how mutation and sexual reproduction contribute to the amount of genetic variation in a population.</p> <p>CLE 3216.4.2 Describe the relationship between phenotype and genotype.</p> <p>CLE 3216.4.3 Predict the probable outcome of genetic crosses based on Mendel’s laws of segregation and independent assortment.</p> <p>CLE 3216.4.4 Describe the relationship among genes, the DNA code, production of protein molecules, and the characteristics of an organism.</p> <p>CLE 3216.4.5 Explain how the different shapes and properties of proteins are determined by the type, number, and sequence of amino acids.</p> <p>CLE 3216.4.6 Explain how the genetic makeup of cells can be engineered.</p>	<p>3216.4.1 Illustrate the movement of chromosomes and other cellular organelles involved in meiosis.</p> <p>3216.4.2 Provide a detailed explanation of how meiosis and fertilization result in new genetic combinations.</p> <p>3216.4.3 Compare the expected outcome with the actual results of a cross in an organism such as a fruit fly or fast plant.</p> <p>3216.4.4 Develop a model to illustrate the stages of protein synthesis.</p> <p>3216.4.5 Apply the genetic coding rules to predict the sequence of amino acids from a sequence of codons in RNA.</p> <p>3216.4.6 Recognize how various types of mutations affect gene expression and the sequence of amino acids in the encoded protein.</p> <p>3216.4.7 Distinguish among the characteristics of various structural levels found in protein molecules.</p> <p>3216.4.8 Describe the formation of recombinant DNA molecules.</p> <p>3216.4.9 Recognize that genetic engineering can be applied to develop novel biomedical and agricultural products.</p>	

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STANDARD 5—BIODIVERSITY AND CHANGE

Conceptual Strand 5 <i>A rich variety of complex organisms have developed in response to changes in the environment.</i>		Guiding Question 5 <i>How does natural selection explain how organisms have changed over time?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3216.5.1 Identify factors that determine the frequency of an allele in the gene pool of a population.</p> <p>CLE 3216.5.2 Determine how mutation, gene flow, and migration influence population structure.</p>	<p>3216.5.1 Predict how variation within a population affects the survival of a species.</p> <p>3216.5.2 Recognize that natural selection acts on an organism’s phenotype rather than its genotype.</p> <p>3216.5.3 Describe how reproductive and geographic isolation affect speciation.</p> <p>3216.5.4 Analyze population changes in terms of the Hardy-Weinberg principle.</p> <p>3216.5.5 Explain how amount of biodiversity is affected by habitat alteration.</p> <p>3216.5.6 Use fossil evidence, DNA structure, amino acid sequences, and other data sources to construct a cladogram that illustrates evolutionary relationships.</p>	

STANDARD 6—COMPARATIVE ANATOMY AND PHYSIOLOGY

Conceptual Strand 6 <i>All living organisms are both alike and different.</i>		Guiding Question 6 <i>In what ways are all living organisms similar and what makes a species unique?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3216.6.1 Investigate the unity and the diversity among living things.</p> <p>CLE 3216.6.2 Describe the events associated with reproduction from gamete production through birth.</p> <p>CLE 3216.6.3 Compare organ systems of representative animal phyla that regulate gas exchange, process and distribute nutrients, remove wastes, transmit chemical and electrical information, and respond to environmental stimuli.</p>	<p>3216.6.1 Describe how the activities of major body systems help to maintain homeostasis.</p> <p>3216.6.2 Distinguish between various methods of sexual and asexual reproduction.</p> <p>3216.6.3 Create a model that illustrates stages of embryological development.</p> <p>3216.6.4 Develop a representation of the different germ layers and the tissue type into which they develop.</p> <p>3216.6.5 Describe how the nervous and endocrine systems coordinate various body functions.</p> <p>3216.6.6 Develop a multimedia product for an immune disorder or infectious disease to demonstrate the impact on the individual organism.</p> <p>3216.6.7 Observe, model, manipulate, and/or dissect representative specimens of major animal groups.</p> <p>3216.6.8 Compare and contrast the function of the major organ systems found in representative animal species.</p>	

STANDARD 7—BOTANY

Conceptual Strand 7 <i>Plants are essential for life to exist.</i>		Guiding Question 7 <i>What conditions are needed for plants to grow and reproduce?</i>
Course Level Expectations	Checks for Understanding (Formative/Summative Assessment)	State Performance Indicators
<p>CLE 3216.7.1 Describe different plant types plants based on their anatomy and physiology.</p> <p>CLE 3216.7.2 Investigate the relationship between form and function for the major plant structures.</p> <p>CLE 3216.7.3 Examine the anatomical and physiological differences between plants and their growth, reproduction, survival, and coevolution.</p> <p>CLE 3216.7.4 Describe the difference between plants and fungi.</p> <p>CLE 3216.7.5 Investigate the impact of plants on humans.</p>	<p>3216.7.1 Describe the function of plant cellular organelles.</p> <p>3216.7.2 Employ a dichotomous key to identify plants based on their structural characteristics.</p> <p>3216.7.3 Distinguish between the following: vascular and nonvascular plants, spore and seed, gymnosperms and angiosperms, and monocots and dicots.</p> <p>3216.7.4 Investigate the significance of structural and physiological adaptations of plants.</p> <p>3216.7.5 Compare and contrast spore and seed production.</p> <p>3216.7.6 Design an experiment to investigate the function of plant hormones.</p> <p>3216.7.7 Prepare a presentation about plants that are harmful or beneficial to humans.</p> <p>3216.7.8 Describe co-evolution among various plant and animal species.</p>	