**REVIEW SHEET FOR BIOLOGY COMPETENCY TEST MAY 20, 21 2014**

SECTION BIOMOLECULES

* Modeling (using physical or digital tools) the four major categories of organic molecules (carbohydrates, fats, proteins, and nucleic acids) using unique characteristics and primary functions
* Determining how and why each major category of organic molecule is essential to life
* Identifying the six elements most common to biological organisms: carbon, hydrogen, oxygen, nitrogen, phosphorous and sulfur
* Understand the structure, repeating subunits and the method of activity of the group of proteins known as enzymes.
* Demonstrate the properties and functions of enzymes by designing and carrying out an experiment.

SECTION ENERGY AND CHEMISTRY

* Analyzing and explaining how cells carry out a variety of chemical transformations that allow conversion of energy from one form to another, the breakdown of molecules into smaller units, and the building of larger molecules from smaller ones
* *Assessments will not include the molecular basis of enzyme function*
* Recognizing that most chemical transformations are made possible by protein catalysts called enzymes
* Identifying enzymes as proteins, and determining how they catalyze biochemical reactions
* *Assessments will not include the molecular basis of enzyme catalysis*
* Conducting experiments to demonstrate that the activities of enzymes are affected by the temperature, ionic conditions, and the pH of the surroundings

SECTION CELL FUNCTION

* Modeling how processes are regulated both internally and externally by environments in which cells exist
* Explaining how the fundamental life processes of organisms depend on a variety of chemical reactions that occur in specialized areas of the organism's cells
* *Assessments will not include the identification of cellular organelles*
* Modeling 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
* *Assessments will not include the molecular basis of membrane transport*

SECTION CELL GROWTH AND DIFFERENTIATION

* Explaining 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
* Tracing 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
* *Assessments will not include the details or graphic demonstration of each stage in mitosis*
* Present evidence that supports the concept that complex multicellular organisms are formed as a highly organized arrangement of differentiated cells
* Providing examples of how different parts of the genetic instructions are influenced by the cell’s environment

SECTION GENES

* Identifying 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
* *Assessments will not include the names and structures of nucleotides or the individual detailed steps of the processes of transcription and translation*
* Relating the specialization of cells in multicellular organisms to the different patterns of gene expression rather than to differences of the genes themselves
* Applying these understandings to analyze, support and/or critique current and emerging biotechnologies
* *Assessments will not include the mechanisms of biotechnologies such as PCR, electrophoresis*

SECTION MUTATIONS

* Describing 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
* *Assessments will not include the identification of specific tissues, organs or body systems*
* Recognizing that certain chemicals, pathogens, and high-energy radiation can seriously impair normal cell functions and the health of the organism
* *Assessments will not include the specific mechanisms of action of mutagens*
* Identifying emerging biotechnology that shows promise in preventing and treating disease
* *Assessments will not include the mechanisms of biotechnologies such as PCR, electrophoresis or the molecular actions of specific treatments*

SECTION ELEMENT CYCLES

* Tracing the cycling of atoms and molecules on Earth among the living and nonliving components of the biosphere
* Explaining how molecules are used to assemble larger molecules with biological activity (including proteins, DNA, sugars and fats)
* *Assessments will not include the representations of specific detailed steps of synthesis and decomposition (intermediate steps and molecules, details of dehydration synthesis)*
* Following the transfer of matter (molecules) from one organism to another repeatedly and between organisms and their physical environment
* Identifying how the total amount of matter in a system remains constant, even though its form and location change

SECTION FOOD WEBS

* Explaining how food webs are limited and how pyramidal relationships exist
* Recognizing 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
* Recognizing 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
* *Assessments will not include the representations of specific detailed steps of synthesis and decomposition (intermediate steps and molecules, details of dehydration synthesis)*
* Calculating the trends in production, use and transfer of energy from one trophic level to another using data

SECTION ECOLOGY

* Tracing 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
* *Assessments will not include the representations of specific detailed steps of photosynthesis and respiration (intermediate steps and products of the Calvin cycle, Krebs/citric acid cycle, and glycolysis)*
* Recognizing 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

SECTION PHOTOSYNTHESIS AND CELLULAR RESPIRATION

* Recognizing the process of photosynthesis as providing a vital connection between the sun and the energy needs of living systems
* Describing how plants capture energy by absorbing light and use it to form strong chemical bonds between the atoms of carbon-containing molecules
* *Assessments will not include the representations of specific detailed steps of photosynthesis (intermediate steps and products of the light-dependent and light-independent reactions)*
* Designing independent investigations to determine the effects of changing environmental factors on photosynthesis

SECTION CELL RESPIRATION AND FUNCTION

* Examining 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
* Tracing 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
* *Assessments will not include the representations of specific detailed steps of respiration (intermediate steps and products of the Krebs/citric acid cycle and glycolysis)*
* Recognizing 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
* *Assessments will not include the representations of specific detailed steps of synthesis and decomposition (intermediate steps and molecules, details of dehydration synthesis)*

SECTION POPULATION GENETICS

* Analyzing the interactions between organisms that result from the ability to produce populations of infinite size in an environment where resources are finite
* Providing evidence of how organisms both cooperate and compete in ecosystems
* Using evidence to explain why interrelationships and interdependencies of organisms may generate stable ecosystems

SECTION HUMAN IMPACT ON THE ENVIRONMENT

* Identifying situations where humans intentionally and unintentionally modify ecosystems as a result of population growth, technology, and consumption
* Providing evidence of how human destruction of habitats threatens current local and global ecosystem stability
* Predicting how direct harvesting, pollution, atmospheric changes, and other factors will affect population dynamics in a given ecosystem based on data and accepted mathematical models
* Predicting how natural disasters such as hurricanes, floods, volcanoes will affect population dynamics in a given ecosystem based on data and accepted mathematical models

SECTION GENETICS

* Recognizing 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)
* *Assessments will not include the identification of the structure of specific nucleotides or the nature of bonding between DNA strands*
* Explaining how the chemical and structural properties of DNA allow for genetic information to be both encoded in genes and replicated
* *Assessments will not include the individual detailed steps of the processes of transcription and translation*
* Identifying that hereditary information is contained in genes, located in the chromosomes of each cell, and each gene carries a single unit of information
* Providing 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
* Analyzing 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)
* Recognizing 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
* Explaining that only mutations in germ cells can create the variation that changes an organism's offspring
* *Assessments will not include the specific detailed steps of meiosis*
* Tracing the progression of conditions that result from genetic mutation in a variety of different organisms
* Explaining 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
* *Assessments will not include the specific detailed steps of meiosis, fertilization and early embryological development*
* Explaining how sexually produced offspring are never identical to either of their parents
* Understanding how new heritable characteristics can result from new combinations of existing genes in reproductive cells
* Recognizing how heritable characteristics can strongly influence what capabilities an organism will have, therefore influencing how likely it is to survive and reproduce

SECTION GENETICS AND EVOLUTION

* Recognizing how heritable characteristics can strongly influence how likely an individual is to survive and reproduce
* Describing how evolution involves changes in the genetic make-up of whole populations over time, not changes in the genes of an individual organism
* Analyzing 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

SECTION GENETIC ENGINEERING

* Identifying, explaining and demonstrating how technology can be used to determine evolutionary relationships among species (gel electrophoresis, DNA/amino acid sequences)
* *Assessments will not include the mechanisms of biotechnologies such as PCR, electrophoresis*
* Integrating scientific information from a variety of disciplines to provide evidence for the relatedness of species on Earth (geology, comparative anatomy, biochemistry, and taxonomy)

SECTION EVOLUTION AND CLASSIFICATION

* Recognizing that a change in a species over time does not follow a set pattern or timeline
* Explaining how the millions of different species on Earth today are related by common ancestry using evidence
* Using 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
* *Assessments will not include the classification of organisms in taxa*

SECTION EVOLUTION AND HARDY WEINBURG

* Discussing how environmental pressure, genetic drift, mutation and competition for resources influence the evolutionary process
* Predicting possible evolutionary implications for a population due to environmental changes over time (e.g., volcanic eruptions, global climate change, pollution)

**CARBON CYCLE**

PHOTOSYNTHESIS

CELL RESPIRATION

**ENERGY PYRAMID**

**BIOMOLECULES**