

END OF INSTRUCTION BIOLOGY:

BIOLOGY I

Process and Inquiry Standards and Objectives

The Priority Academic Student Skills (PASS) should be taught by investigating content, concepts, and principles of major themes in the Biological Sciences.

Standard 1: Observe and Measure—Observing is the first action taken by the learner to acquire new information about an organism or event. Opportunities for observation are developed through the use of a variety of scientific tools. Measurement allows observations to be quantified. The student will accomplish these objectives to meet this process standard.

1. Identify qualitative and quantitative changes in cells, organisms, populations, and ecosystems given conditions (e.g., temperature, mass, volume, time, position, length, quantity, etc.) before, during, and after an event.
2. Use appropriate tools (e.g., microscope, pipette, metric ruler, graduated cylinder, thermometer, balances, stopwatches, etc.) when measuring cells, organisms, populations, and ecosystems.
3. Use appropriate System International (SI) units (i.e., grams, meters, liters, degrees Celsius, and seconds); and SI prefixes (i.e., micro-, milli-, centi-, and kilo-) when measuring cells, organisms, populations, and ecosystems.

Standard 2: Classify—Classifying establishes order. Organisms and events are classified based on similarities, differences, and interrelationships. The student will accomplish these objectives to meet this process standard.

1. Using observable properties, place cells, organisms, and/or events into a biological classification system.
2. Identify the properties by which a biological classification system is based.

Standard 3: Experiment—Experimenting is a method of discovering information. It requires making observations and measurements to test ideas. The student will accomplish these objectives to meet this process standard.

1. Evaluate the design of a biology laboratory investigation.
2. Identify the independent variables, dependent variables, and controls in an experiment.
3. Use mathematics to show relationships within a given set of observations (e.g., population studies, biomass, probability, etc.).
4. Identify a hypothesis for a given problem in biology investigations.
5. Recognize potential hazards and practice safety procedures in all biology activities.

Standard 4: Interpret and Communicate—Interpreting is the process of recognizing patterns in collected data by making inferences, predictions, or conclusions. Communicating is the process of describing, recording, and reporting experimental procedures and results to others. Communication may be oral, written, or mathematical and includes: organizing ideas, using appropriate vocabulary, graphs, other visual representations, and mathematical equations. The student will accomplish these objectives to meet this process standard.

1. Select appropriate predictions based on previously observed patterns of evidence.
- *2. Report data in an appropriate manner.
3. Interpret data tables and line, bar, trend, and/or circle graphs.
4. Accept or reject hypotheses when given results of a biological investigation.
5. Evaluate experimental data to draw the most logical conclusion.
- *6. Prepare a written report describing the sequence, results, and interpretation of a biological investigation or event.
- *7. Communicate or defend scientific thinking that results in conclusions.
8. Identify and/or create an appropriate graph or chart from collected data, tables, or written description (e.g., population studies, plant growth, heart rate, etc.).

Standard 5: Model—Modeling is the active process of forming a mental or physical representation from data, patterns, or relationships to facilitate understanding and enhance prediction.

The student will accomplish these objectives to meet this process standard.

1. Interpret a biological model which explains a given set of observations.
2. Select predictions based on models such as pedigrees, life cycles, energy pyramids, etc.
- *3. Compare a given model to the living world.

Standard 6: Inquiry—Inquiry can be defined as the skills necessary to carry out the process of scientific or systemic thinking. In order for inquiry to occur, students must have the opportunity to ask a question, formulate a procedure, and observe phenomena. The

student will accomplish these objectives to meet this process standard.

- *1. Formulate a testable hypothesis and design an appropriate experiment relating to the living world.
- *2. Design and conduct biological investigations in which variables are identified and controlled.
- *3. Use a variety of technologies, such as hand tools, microscopes, measuring instruments, and computers to collect, analyze, and display data.
- *4. Inquiries should lead to the formulation of explanations or models (physical, conceptual, and mathematical). In answering questions, students should engage in discussions (based on scientific knowledge, the use of logic, and evidence from the investigation) and arguments that encourage the revision of their explanations, leading to further inquiry.

PRIORITY ACADEMIC STUDENT SKILLS

BIOLOGY I

Content Standards and Objectives

Standard 1: The Cell—Cells are the fundamental unit of life, composed of a variety of structures that perform functions necessary to maintain life. The student will engage in investigations that integrate the process standards and lead to the discovery of the following objectives:

1. Cells are composed of a variety of structures, such as the nucleus, cell membrane, cell wall, cytoplasm, ribosomes, mitochondria, and chloroplasts.
2. Cells can differentiate and may develop into complex multicellular organisms (i.e., cells, tissues, organs, organ systems, organisms).

Standard 2: The Molecular Basis of Heredity—DNA determines the characteristics of organisms.

The student will engage in investigations that integrate the process standards and lead to the discovery of the following objectives:

1. Cells function according to the information contained in the master code of DNA (i.e., cell cycle, DNA to DNA, and DNA to RNA). Transfer RNA and protein synthesis will be taught in life science courses with rigor greater than Biology I.
2. A sorting and recombination of genes in reproduction results in a great variety of possible gene combinations from the offspring of any two parents (i.e., Punnett squares and pedigrees). Students will understand the following concepts in a single trait cross: alleles, dominant trait, recessive trait, phenotype, genotype, homozygous, and heterozygous.

Standard 3: Biological Diversity—Diversity of species is developed through gradual processes over many generations. The student will engage in investigations that integrate the process standards and lead to the discovery of the following objectives:

1. Different species might look dissimilar, but the unity among organisms becomes apparent from an analysis of internal structures, the similarity of their chemical processes, and the evidence of common ancestry (e.g., homologous and analogous structures).
2. Species acquire many of their unique characteristics through biological adaptation, which involves the selection of naturally occurring variations in populations. Biological adaptations include changes in structures, behaviors, or physiology, which may enhance or limit the survival and reproductive success in a particular environment.

Standard 4: The Interdependence of Organisms—The interrelationships and interactions between and among organisms in an environment. The student will engage in investigations that integrate the process standards and lead to the discovery of the following objectives:

1. Matter on the earth cycles among the living and nonliving components of the biosphere.
2. Organisms both cooperate and compete in ecosystems (i.e., parasitism and symbiosis).
3. Living organisms have the capacity to produce populations of infinite size, but environments and resources limit population size (e.g., carrying capacity and limiting factors).

Standard 5: Matter, Energy, and Organization in Living Systems—Living systems require a continuous input of energy to maintain their chemical and physical organizations. The

student will engage in investigations that integrate the process standards and lead to the discovery of the following objectives:

1. The complexity and organization of organisms accommodate the need for obtaining, transforming, transporting, releasing, and eliminating the matter and energy used to sustain the organism (i.e., photosynthesis and cellular respiration).
2. As matter and energy flow through different levels of organization of living systems and between living systems and the physical environment, chemical elements are recombined in different ways by different structures. Matter and energy are conserved in each change (i.e., water cycle, carbon cycle, nitrogen cycle, food webs, and energy pyramids).

Standard 6: The Behavior of Organisms—Organisms have behavioral responses to internal changes and to external stimuli. The student will engage in investigations that integrate the process standards and lead to the discovery of the following objectives:

1. Specialized cells enable organisms to monitor what is going on in the world around them (e.g., detect light, sound, specific chemicals, gravity, plant tropism, sense organs, homeostasis, etc.).
2. Responses to external stimuli can result from interactions with the organism's own species and others, as well as environmental changes; these responses can be either innate or learned. Broad patterns of behavior exhibited by animals have changed over time to ensure reproductive success.