

# Missouri Educator Gateway Assessments

## FIELD 016: BIOLOGY TEST FRAMEWORK

January 2014

**DRAFT**

<b>Content Domain</b>	<b>Range of Competencies</b>	<b>Approximate Percentage of Test Score</b>
I. Science and Engineering Practices	0001–0003	21%
II. Biochemistry and Cell Biology	0004–0005	14%
III. Genetics and Evolution	0006–0009	29%
IV. Biological Unity and Diversity	0010–0011	14%
V. Ecology and Environment	0012–0014	22%

**Missouri Educator Gateway Assessments**  
**TEST FRAMEWORK**  
**FIELD 016: BIOLOGY**

**SCIENCE AND ENGINEERING PRACTICES**

**0001 Understand the practices of scientific inquiry and engineering design.**

For example:

- 1.1 Apply knowledge of the principles and procedures for designing and carrying out scientific investigations.
- 1.2 Recognize methods and criteria for collecting, organizing, analyzing, and presenting scientific data.
- 1.3 Analyze the evidential basis of scientific claims and engineering solutions.
- 1.4 Apply knowledge of safety procedures and hazards associated with scientific investigations.
- 1.5 Demonstrate knowledge of the materials, equipment, and technology used in the sciences.
- 1.6 Apply mathematical procedures and modeling to the analysis and interpretation of data and to solve problems in the sciences.
- 1.7 Apply knowledge of engineering design practices to solve a problem or address a need (e.g., defining problems, designing and evaluating solutions, optimizing solutions).

**0002 Understand crosscutting concepts in the sciences and engineering.**

For example:

- 2.1 Demonstrate knowledge of the crosscutting concepts that unite core ideas across the sciences and engineering (e.g., patterns, cause and effect, stability and change).
- 2.2 Apply knowledge of the nature of science as a system of inquiry based on a set of shared characteristics (e.g., empirical evidence, peer review, ethics in experimentation and in the reporting of results).
- 2.3 Demonstrate knowledge of the historical development of major scientific ideas, including contributions by men and women of diverse backgrounds.
- 2.4 Demonstrate knowledge of major contemporary theories, laws, models, and concepts in chemistry, physics, and Earth and space science.
- 2.5 Apply literacy skills to the interpretation, synthesis, and analysis of information from scientific and technical sources (e.g., explaining central ideas, interpreting domain-specific terminology, recognizing how texts structure information into categories and hierarchies).

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### **0003 Understand the relationships between science, technology, and human activity in a global context.**

For example:

- 3.1 Demonstrate knowledge of ways in which science and technology can be used to solve problems affecting society (e.g., alternative fuels, medical imaging, pollution).
- 3.2 Recognize the ways in which society affects scientific progress.
- 3.3 Recognize how technology is used in the sciences and the scientific advances its use has made possible.
- 3.4 Evaluate the accuracy of reported scientific information and the credibility of the reporting source (e.g., scientific journals, newspapers, Web sites).
- 3.5 Analyze social, economic, and ethical issues and contexts associated with technological and scientific developments.

## **BIOCHEMISTRY AND CELL BIOLOGY**

### **0004 Understand the chemistry of living systems.**

For example:

- 4.1 Demonstrate knowledge of basic chemistry, including the characteristics of atoms and molecules and the physical and chemical properties of water and carbon and the biological significance of these properties.
- 4.2 Analyze biological phenomena at the cellular level in terms of the basic principles of thermodynamics and the properties of chemical reactions and covalent, ionic, and hydrogen bonds.
- 4.3 Analyze the structure and function of macromolecules (e.g., carbohydrates, lipids, nucleic acids, proteins) and their monomers, including metabolic pathways involving their synthesis and breakdown.
- 4.4 Analyze the structure and function of enzymatic molecules and their role in regulating metabolism.

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### **0005 Understand cell structure, function, and bioenergetics.**

For example:

- 5.1 Analyze the structure and function of membranes, organelles, and other cellular components in prokaryotic and eukaryotic cells and the mechanisms by which cells maintain homeostasis.
- 5.2 Analyze the process of photosynthesis and cellular respiration.
- 5.3 Analyze the specializations of cells and differentiate cell types.
- 5.4 Demonstrate knowledge of binary fission, mitosis, the stages of the cell cycle, and factors affecting the growth and division of cells.
- 5.5 Demonstrate knowledge of the differentiation of cells during and after embryonic development, including factors affecting cell differentiation.

## **GENETICS AND EVOLUTION**

### **0006 Understand molecular genetics.**

For example:

- 6.1 Analyze the synthesis, structure, and function of nucleic acids; gene structure and function and factors controlling gene expression; and the processes involved in protein synthesis.
- 6.2 Analyze the types and causes of chromosomal and gene mutations, the consequences of these genetic changes, and the genetic basis of common disorders and diseases.
- 6.3 Demonstrate knowledge of basic methods and applications of genetic engineering (e.g., restriction enzymes, DNA sequencing, recombinant DNA).

### **0007 Understand patterns and processes of inheritance.**

For example:

- 7.1 Analyze meiosis and fertilization and their roles in sexual life cycles.
- 7.2 Analyze patterns of inheritance and the relationship between genotypic and phenotypic frequencies.
- 7.3 Demonstrate knowledge of the chromosomal basis of inheritance and its relationship to observed inheritance patterns, and of the characteristics of extranuclear inheritance in plants and animals.
- 7.4 Solve genetics problems.

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### **0008 Understand the mechanisms of biological evolution.**

For example:

- 8.1 Demonstrate knowledge of population genetics (e.g., Hardy-Weinberg equilibrium) and the sources and significance of variation in populations.
- 8.2 Apply knowledge of the mechanisms of natural and artificial selection.
- 8.3 Analyze evolutionary patterns and the mechanisms of speciation.

### **0009 Understand the scientific explanations and evidence for the history of life on Earth.**

For example:

- 9.1 Demonstrate knowledge of the geologic history of Earth, current scientific theories on the origin of life, biologically significant events in Earth's history, and the fossil record.
- 9.2 Demonstrate knowledge of the principles of biological classification, phylogenetic trees and their cladistic basis, evolutionary relationships of major groups of organisms, and evolution as a unifying principle in biology.
- 9.3 Analyze different kinds of scientific evidence for evolution.

## **BIOLOGICAL UNITY AND DIVERSITY**

### **0010 Understand the structures and functions of organisms and their life cycles.**

For example:

- 10.1 Demonstrate knowledge of the characteristics of viruses, prokaryotes, protists, and fungi, including their reproduction and life cycles.
- 10.2 Apply knowledge of the characteristics of the major groups of plants, including their reproduction and life cycles.
- 10.3 Apply knowledge of the characteristics of the major groups of animals, including their reproduction and life cycles.
- 10.4 Demonstrate knowledge of the general structure, organization, and function of human organ systems; and the causes, characteristics, and avoidance of common diseases.

## **FIELD 016: BIOLOGY TEST FRAMEWORK**

### **0011 Understand how organisms obtain, store, and use energy and matter to maintain homeostasis.**

For example:

- 11.1 Analyze how prokaryotes, protists, and fungi obtain, store, and use energy, nutrients, and water to maintain homeostasis.
- 11.2 Analyze how plants obtain, store, and use energy, nutrients, and water to maintain homeostasis.
- 11.3 Analyze how animals obtain, store, and use energy, nutrients, and water to maintain homeostasis.
- 11.4 Analyze the homeostatic relationships of human organ systems.

## **ECOLOGY AND ENVIRONMENT**

### **0012 Understand populations and communities.**

For example:

- 12.1 Analyze the interactions of biotic and abiotic factors that limit or regulate population size, including the difference between density-independent and density-dependent factors.
- 12.2 Analyze the behavior of organisms and the relationship of behavior to various social systems.
- 12.3 Analyze demographic characteristics, life history patterns, population growth curves, and survivorship curves for populations occurring in different habitats and under different conditions.
- 12.4 Analyze the composition of biological communities, the types of relationships that exist between organisms in communities, the concept of ecological niche, and factors that produce change in communities.

### **0013 Understand ecosystems and biomes.**

For example:

- 13.1 Analyze energy flow and biogeochemical cycling in ecosystems.
- 13.2 Demonstrate knowledge of different types of biomes, their geographical distribution and physical characteristics, and their typical flora and fauna.
- 13.3 Analyze the trophic roles of organisms in different ecosystems.
- 13.4 Recognize the ways in which environmental changes and the geomorphology of Missouri (e.g., soil and rock types, land formations) affect ecosystems and species diversity.

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TEST FRAMEWORK**

**0014 Understand the effects of human activities on the biosphere.**

For example:

- 14.1 Analyze the effects of human activities on aquatic populations, communities, and ecosystems, and the implications of these effects for humans and other organisms.
- 14.2 Analyze the effects of human activities on terrestrial populations, communities, and ecosystems, and the implications of these effects for humans and other organisms.
- 14.3 Analyze the effects of human activities on the atmosphere and climate and the implications of these effects for humans and other organisms.