Missouri Educator Gateway Assessments

FIELD 016: BIOLOGY
TEST FRAMEWORK

June 2014

Content Domain		Range of Competencies	Approximate Percentage of Test Score
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%

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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).

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.

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.

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.

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.

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 in particular the implications of global climate change for humans and other organisms.