

Missouri Educator Gateway Assessments

FIELD 019: EARTH SCIENCE TEST FRAMEWORK

June 2014

Content Domain	Range of Competencies	Approximate Percentage of Test Score
I. Science and Engineering Practices	0001–0003	18%
II. Geosphere	0004–0007	25%
III. Hydrosphere	0008–0010	19%
IV. Atmosphere, Weather, and Climate	0011–0013	19%
V. Astronomy	0014–0016	19%

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TEST FRAMEWORK
FIELD 019: EARTH SCIENCE

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 biology, chemistry, and physics.
- 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 address problems affecting society (e.g., the need for alternative fuels, acid rain, water 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.

GEOSPHERE

0004 Understand historical geology.

For example:

- 4.1 Demonstrate knowledge of relative dating and the use of technology in absolute dating to develop the geologic time scale.
- 4.2 Recognize causes and consequences of major events in Earth's geologic history.
- 4.3 Demonstrate knowledge of Earth's origin and the development of the atmosphere and hydrosphere.
- 4.4 Apply knowledge of the origin and history of life, the fossil record, the process of fossil formation, and the theory of evolution.

0005 Understand plate tectonics and the rock cycle.

For example:

- 5.1 Analyze the landforms and geologic features that result from tectonic processes and the evidence and methods used to establish the theory of plate tectonics.
- 5.2 Apply knowledge of the causes, characteristics, and impacts of different types of volcanic activity and the nature of erupted materials.
- 5.3 Apply knowledge of the causes, characteristics, and impacts of the geologic faulting and folding associated with earthquakes and mountain building.
- 5.4 Analyze the physical and chemical processes involved in the formation of metamorphic, igneous, and sedimentary rocks within the rock cycle.

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0006 Understand Earth materials, geologic resources, and Earth's internal structure.

For example:

- 6.1 Demonstrate knowledge of the origin, characteristics, and classification of minerals, soil types, and rocks.
- 6.2 Analyze the formation, extraction, and use of geologic resources, and factors affecting their availability, including conservation.
- 6.3 Demonstrate knowledge of Earth's interior and the evidence and methods used to study Earth's internal structure.
- 6.4 Analyze energy flow and geochemical cycling in Earth's geosphere.
- 6.5 Analyze how the geomorphology of Missouri affects the survival of organisms and influences land use decisions.

0007 Understand the processes of weathering, erosion, and deposition.

For example:

- 7.1 Analyze the processes and effects of physical and chemical weathering.
- 7.2 Analyze erosional processes and the impacts of erosion.
- 7.3 Demonstrate knowledge of the physical properties of alpine and continental glaciers and the ways in which they alter the landscape.
- 7.4 Apply knowledge of the processes of sediment transport and deposition in aquatic and terrestrial environments.
- 7.5 Apply knowledge of how climatic and geographic conditions affect the landscape.

HYDROSPHERE

0008 Understand the hydrologic cycle and its interaction with other Earth systems.

For example:

- 8.1 Analyze the physical properties of water, including energy changes that occur in the hydrologic cycle.
- 8.2 Demonstrate knowledge of the chemical properties of water, including its role as a solvent in the environment, and how water chemistry changes during the hydrologic cycle.
- 8.3 Analyze the interrelationship of the hydrosphere and other Earth systems.

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0009 Understand the composition, structure, and properties of oceans.

For example:

- 9.1 Demonstrate knowledge of the origins and physical structures of ocean basins and different types of coastlines.
- 9.2 Analyze the physical and chemical characteristics of ocean water.
- 9.3 Demonstrate knowledge of the causes and characteristics of ocean currents, waves, and tides.
- 9.4 Analyze the characteristics, formation, management, and use of geologic and biological marine resources.

0010 Understand the characteristics and properties of freshwater systems.

For example:

- 10.1 Apply knowledge of the properties of surface water, factors affecting stream flow, the dynamics of drainage systems, and the functions of watersheds.
- 10.2 Apply knowledge of the properties of groundwater, including factors affecting the movement, infiltration, extraction, and quality of groundwater resources.
- 10.3 Analyze geologic factors affecting the availability, use, and management of freshwater resources.

ATMOSPHERE, WEATHER, AND CLIMATE

0011 Understand the structure and properties of the atmosphere.

For example:

- 11.1 Recognize the characteristics of the different layers and components of the atmosphere, and the role of gases and particulates in regulating conditions on Earth.
- 11.2 Analyze global wind patterns in relation to the Coriolis effect and the differential heating of Earth's surface by the sun.
- 11.3 Demonstrate knowledge of the causes and pervasive effects of changes to the atmosphere due to human or natural activities.

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0012 Understand the characteristics of weather systems and the circumstances under which various weather conditions develop.

For example:

- 12.1 Demonstrate knowledge of the characteristics of high- and low-pressure systems, air masses, and fronts and the conditions under which these weather phenomena typically form.
- 12.2 Analyze the conditions that produce different types of clouds, precipitation, and weather, including the effects of the subtropical and polar front jet streams.
- 12.3 Analyze the effects of geography and/or bodies of water on weather formation, including severe weather.
- 12.4 Apply knowledge of weather maps and symbols and the instruments used to measure and predict weather conditions.

0013 Understand Earth's climate systems and the factors that influence climate.

For example:

- 13.1 Apply knowledge of the biotic and abiotic characteristics of Earth's major climate regions.
- 13.2 Analyze the geographic factors and conditions responsible for unique climate phenomena, such as monsoons and the El Niño-Southern Oscillation (ENSO).
- 13.3 Demonstrate knowledge of the causes and effects of current and past changes in global climate, including supporting evidence and the interrelationships of ecosystems, the hydrologic cycle, and human society.

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ASTRONOMY

0014 Understand the characteristics of stars, galaxies, and the universe.

For example:

- 14.1 Demonstrate knowledge of the sun's structure, life cycle, and energy production.
- 14.2 Demonstrate knowledge of the characteristics and evolution of different types of stars, including the process of nucleosynthesis.
- 14.3 Recognize the characteristics of the Milky Way and other types of galaxies.
- 14.4 Analyze theories of the origin and nature of the universe and the characteristics of black holes, dark matter, supernovas, and quasars.
- 14.5 Demonstrate knowledge of the technology used to explore and the evidence used to understand the solar system, stars, extrasolar planets, galaxies, and the universe.

0015 Understand the characteristics and components of the solar system.

For example:

- 15.1 Demonstrate knowledge of the origin and structure of the solar system.
- 15.2 Demonstrate knowledge of the position and characteristics of the planets and their satellites.
- 15.3 Demonstrate knowledge of the origin and characteristics of comets, asteroids, and meteors.
- 15.4 Recognize the physical and mathematical models and laws that describe the motions of objects in the solar system.

0016 Understand the sun-moon-Earth system and the apparent motions of stars and planets.

For example:

- 16.1 Demonstrate knowledge of the physical characteristics of the moon and Earth, including theories on their origin and the evidence used to support those theories.
- 16.2 Analyze the interactions of the sun, moon, and Earth, including the effects of these interactions on Earth systems and the evolution of the sun-moon-Earth system.
- 16.3 Analyze the apparent motions of stars and planets relative to Earth, and the characteristics of the celestial sphere.