



EARTH AND SPACE SCIENCE

Test Framework

	Content Domain	Range of Competencies	Approximate Percentage of Test Score
I.	Nature of Science	0001–0003	18%
II.	Geology	0004–0007	25%
III.	Oceanography and Freshwater Systems	0008–0010	19%
IV.	The Atmosphere, Weather, and Climate	0011–0013	19%
V.	Astronomy	0014–0016	19%

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I. NATURE OF SCIENCE

0001 Understand principles and processes of scientific inquiry.

- ▶ Demonstrate knowledge of the principles and processes for designing and carrying out scientific investigations.
- ▶ Apply methods and criteria for collecting, organizing, interpreting, analyzing, synthesizing, and presenting scientific data.
- ▶ Recognize the evidential basis of scientific claims.
- ▶ Demonstrate knowledge of safety procedures and hazards associated with Earth and space science investigations and the materials, equipment, and technology used in Earth and space science.
- ▶ Apply appropriate mathematical procedures, units, and scientific notation in reporting data and solving problems in Earth and space science.

0002 Understand the history and nature of science.

- ▶ Demonstrate knowledge of the historical development of major scientific ideas.
- ▶ Demonstrate knowledge of major contemporary theories, models, and concepts in the other sciences, including physics, chemistry, and biology.
- ▶ Demonstrate knowledge of unifying themes, principles, and relationships that connect the different branches of the sciences and the uses and limitations of models.
- ▶ Demonstrate knowledge of the major principles of the nature of science and its characteristics as a system of inquiry.

0003 Understand the relationships between science, technology, engineering, and mathematics.

- ▶ Analyze the interrelationships of science, technology, engineering, and mathematics in the Earth and space sciences.
- ▶ Evaluate scientific research and the validity of coverage of science in the media.
- ▶ Analyze social, economic, and ethical issues associated with technological and scientific developments.
- ▶ Demonstrate knowledge of maps, models, and other geospatial technologies used to present scientific information.

II. GEOLOGY

0004 Understand historical geology.

- ▶ Demonstrate knowledge of relative dating and the use of technology in absolute dating to develop the geologic time scale.
- ▶ Recognize causes and consequences of major events in Earth's geologic history.
- ▶ Demonstrate knowledge of Earth's origin and the development of the atmosphere and hydrosphere.
- ▶ Demonstrate 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.

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

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

- ▶ Demonstrate knowledge of the origin, characteristics, and classification of minerals, soil types, and rocks.
- ▶ Analyze the formation, extraction, and use of geologic resources.
- ▶ Demonstrate knowledge of Earth's interior and the evidence and methods used to study Earth's internal structure.

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

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

III. OCEANOGRAPHY AND FRESHWATER SYSTEMS

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

- ▶ Analyze the physical properties of water, including energy changes that occur in the hydrologic cycle.
- ▶ Demonstrate knowledge of the chemical properties of water and how water chemistry changes during the hydrologic cycle.
- ▶ Analyze the interrelationship of the hydrosphere and other Earth systems.

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

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

0010 Understand the characteristics and properties of freshwater systems.

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

IV. THE ATMOSPHERE, WEATHER, AND CLIMATE

0011 Understand the structure and properties of the atmosphere.

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

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

- ▶ 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.
- ▶ Analyze the conditions that produce different types of clouds, precipitation, and weather, including the effects of the subtropical and polar front jet streams.
- ▶ Analyze the effects of geography and/or bodies of water on weather formation, including severe weather.
- ▶ 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.

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

V. ASTRONOMY

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

- ▶ Demonstrate knowledge of the sun's structure, life cycle, and energy production.
- ▶ Demonstrate knowledge of the characteristics and evolution of different types of stars, including the process of nucleosynthesis.
- ▶ Recognize the characteristics of the Milky Way Galaxy and other types of galaxies.
- ▶ Analyze theories of the origin and nature of the universe and the characteristics of black holes, dark matter, supernovas, and quasars.
- ▶ 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 characteristics and components of the solar system.

- ▶ Demonstrate knowledge of the origin and structure of the solar system.
- ▶ Recognize the position and characteristics of the planets and their satellites.
- ▶ Recognize the origin and characteristics of comets, asteroids, and meteors.
- ▶ 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.

- ▶ Demonstrate knowledge of the physical characteristics of the moon and Earth, including theories on their origin and the evidence used to support those theories.
- ▶ 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.
- ▶ Analyze the apparent motions of stars and planets relative to Earth, and the characteristics of the celestial sphere.