



## TEST DESIGN AND FRAMEWORK

### TEST DESIGN

#### Science

The **Science** assessment consists of **two tests**. Each test contains a section with selected-response questions and a section with constructed-response assignments. Each section counts for a percentage of your total test score. The areas of content assessed by each test, the approximate number of selected-response questions and constructed-response assignments in each content area, and the percentage of your total test score derived from each test section are shown in the tables below. Further information regarding the content included in each subarea can be found in the test framework.

#### ■ Test I (Test Code 024)

Subareas:	Objectives	Approximate Number of Selected-Response Questions	Constructed-Response Assignments
➤ Earth Science	0001–0005	30	1
➤ Life Science	0006–0010	30	1
<b>TOTAL</b>		<b>60</b>	<b>2</b>
<b>Percentage of Test Score</b>		<b>80%</b>	<b>20%</b>

#### ■ Test II (Test Code 025)

Subareas:	Objectives	Approximate Number of Selected-Response Questions	Constructed-Response Assignments
➤ Physical Science	0011–0016	36	1
➤ Characteristics of Science	0017–0020	24	1
<b>TOTAL</b>		<b>60</b>	<b>2</b>
<b>Percentage of Test Score</b>		<b>80%</b>	<b>20%</b>



**Georgia Assessments for the  
Certification of Educators®**

## **TEST DESIGN AND FRAMEWORK**

### **TEST FRAMEWORK**

#### **Science**

##### **EARTH SCIENCE**

###### **0001 Understand current scientific views of the universe.**

For example:

- demonstrating knowledge of the historical progression and characteristics of scientific theories of the formation of the universe
- analyzing objects in the solar system and the universe based on their characteristics
- predicting the effects of gravity (e.g., orbits, tidal forces) on objects in the solar system
- analyzing the apparent motions of objects in the sky
- analyzing the effects of the positions, movements, and interactions of the earth, moon, and sun
- demonstrating knowledge of the methods (e.g., spectrometry, red-shift analysis) and types of technology used to observe and collect data about the solar system and the universe

###### **0002 Understand the characteristics and distribution of water and its role in earth processes.**

For example:

- analyzing the properties and behavior of water (e.g., polarity, high specific heat capacity, changes in density) in its different states
- analyzing the water cycle (e.g., evaporation, condensation, precipitation, freezing) and its relationship to various atmospheric conditions and hydrologic systems
- recognizing characteristics and distribution of hydrologic systems on the earth (e.g., rivers, glaciers, groundwater)
- interpreting the composition of the world's oceans with respect to location and subsurface topography
- analyzing the causes and effects of waves, currents, and tides

**0003 Understand characteristics of the atmosphere and climate and weather.**

For example:

- demonstrating knowledge of the basic composition, structure, and properties of the atmosphere
- identifying the processes and patterns of energy transfer in the atmosphere
- comparing heat transfer rates of land and water and analyzing their effects on weather patterns
- recognizing characteristics of global and local weather systems and the causes and effects of weather events
- analyzing the influence of water on the climate and weather of Georgia
- demonstrating knowledge of the methods and types of technology used to observe, measure, and predict climate and weather

**0004 Understand characteristics of the earth and processes that have shaped its surface.**

For example:

- demonstrating knowledge of the earth's structure and composition
- analyzing processes of the rock cycle and classifying rocks based on their characteristics
- describing the characteristics of soil and its formation
- applying knowledge of the theory of plate tectonics and analyzing evidence that supports the theory
- identifying major geological features and analyzing the processes that form and change these features (e.g., tectonic movements, erosion, deposition)
- recognizing characteristics of fossils and their formation
- interpreting evidence (e.g., fossils, trapped gases) of the changing surface and climate of the earth

**0005 Understand the earth's natural resources.**

For example:

- identifying types and characteristics of renewable and nonrenewable resources and analyzing factors that influence how they are used
- recognizing the sun as the major source of energy on the earth's surface and analyzing its relationship to wind and water energy
- recognizing the sources of geothermal energy
- analyzing the effects of human activities on the earth's natural resources
- demonstrating knowledge of methods for conserving and protecting natural resources

**LIFE SCIENCE**

**0006 Understand the diversity of living organisms and their classification.**

For example:

- recognizing major characteristics of organisms from different biological kingdoms
- comparing and contrasting prokaryotic and eukaryotic cells
- classifying organisms using various strategies and criteria
- developing and using dichotomous keys
- analyzing the evolutionary basis of modern classification systems

**0007 Understand the structure and function of living systems.**

For example:

- demonstrating knowledge of the relationship between the structure of plant and animal cell organelles and basic cell functions
- relating the structure and function of macromolecules in cells
- analyzing levels of organization from the cell to the biosphere
- recognizing the structure and function of cells, tissues, and organs in the major organ systems in humans
- comparing how various organisms carry out basic life processes (e.g., reproducing, obtaining nutrients, maintaining homeostasis)
- explaining the major chemical processes (e.g., photosynthesis, cellular respiration, transport mechanisms) that support living organisms

**0008 Understand the principles and processes of the inheritance of biological traits.**

For example:

- identifying the structure and function of DNA, RNA, genes, and chromosomes and analyzing their roles in storing and transmitting information
- comparing and contrasting sexual and asexual reproduction in organisms
- identifying processes that contribute to genetic variability (e.g., meiosis, crossing-over, mutations)
- demonstrating knowledge of the basic principles of inheritance and Mendel's laws and applying these principles and laws to inheritance problems
- demonstrating knowledge of applications of the principles of genetics and DNA technology (e.g., selective breeding, forensics, medicine)

**0009 Understand the dependence of organisms on one another and understand the flow of energy and matter in ecosystems.**

For example:

- recognizing the characteristics of populations, communities, ecosystems, and biomes
- analyzing the flow of energy and matter through the abiotic and biotic components of an ecosystem (e.g., carbon cycle, nitrogen cycle)
- analyzing the symbiotic relationships among organisms in an ecosystem
- analyzing the flow of energy through food chains and food webs
- analyzing factors that affect population dynamics in an ecosystem (e.g., carrying capacity, human activities)
- identifying characteristics of the earth's major terrestrial biomes and aquatic communities

**0010 Understand the theory of evolution and the role of natural selection.**

For example:

- demonstrating knowledge of the historical development of the theory of evolution and supporting evidence (e.g., Darwin's finches)
- recognizing the relationship between natural selection and adaptation
- analyzing the roles of variation, natural selection, nonrandom selection, and isolation in evolutionary change and speciation
- identifying evidence for evolutionary change in organisms over time and for evolutionary relationships among organisms (e.g., fossils, biochemical similarities)

**PHYSICAL SCIENCE****0011 Understand the nature of matter and its classification.**

For example:

- demonstrating knowledge of the structure, properties, and forces within the atom and the historical development of theories of atomic structure
- distinguishing among types of matter (e.g., elements, compounds, mixtures)
- analyzing physical and chemical properties of matter (e.g., malleability, melting point, reactivity)
- demonstrating knowledge of the different types of chemical bonds (i.e., ionic, covalent, and metallic) and how the character of chemical bonds affects the properties of substances
- applying knowledge of the organization of the Periodic Table and its trends to support understanding of/aid in determining the structure and properties of matter
- interpreting chemical symbols, formulas, and IUPAC nomenclature

**0012 Understand changes in matter.**

For example:

- analyzing physical, chemical, and nuclear changes in matter and the factors that affect these changes
- recognizing types, characteristics, and applications of radioactivity and radioactive decay
- applying knowledge of the law of conservation of matter to chemical equations
- identifying the components and properties of solutions, including acids and bases, and factors that affect solubility
- analyzing factors that affect rates of chemical reactions (e.g., temperature, catalysts)
- identifying characteristics of a system at equilibrium

**0013 Understand principles and concepts related to energy.**

For example:

- identifying forms (e.g., mechanical, chemical) and types (e.g., potential, kinetic) of energy and their characteristics
- applying knowledge of the law of conservation of energy in the analysis of physical and chemical systems
- demonstrating knowledge of energy transformations and transfers (e.g., heat transfer, energy conversion) in a system
- applying knowledge of the kinetic molecular theory in the analysis of the properties and behavior of solids, liquids, gases, and plasmas
- applying knowledge of the gas laws (e.g., Boyle's law, Charles's law)
- analyzing phase diagrams (e.g., heat versus temperature) and the flow of energy during changes in states of matter
- determining heat transfer using mass, specific heat, and temperature change

**0014 Understand the relationships among force, mass, and the motion of objects.**

For example:

- comparing types and characteristics of forces (e.g., frictional, gravitational) and analyzing the effects of forces on objects
- analyzing the relationship between the displacement, velocity, and acceleration of an object graphically, algebraically, and in written form
- applying Newton's laws of motion to everyday situations
- solving problems related to motion, force, and momentum
- applying knowledge of the concepts of work, power, efficiency, and mechanical advantage
- identifying types and characteristics of simple machines

**0015 Understand the properties of waves, sound, and light.**

For example:

- comparing and contrasting characteristics of longitudinal waves and transverse waves
- analyzing how the behavior of waves is affected by the medium (e.g., air, water, solids) through which the waves are passing
- analyzing the phenomena of reflection, refraction, interference, diffraction, polarization, dispersion, and absorption
- demonstrating knowledge of characteristics and uses of electromagnetic radiation
- demonstrating knowledge of the properties of sound and light in everyday phenomena (e.g., echoes, Doppler effect, magnification, rainbows)
- demonstrating knowledge of the relationship between the properties of waves and how they are perceived by humans (e.g., color, pitch)

**0016 Understand electricity and magnetism.**

For example:

- identifying the characteristics of static electricity and explaining how it is generated
- applying knowledge of the flow of electrons in circuits, including the relationships between potential difference, resistance, and current
- comparing and contrasting series and parallel circuits and how they transfer energy
- recognizing the characteristics and uses of magnetic domains, magnets, and magnetic fields
- demonstrating knowledge of the relationship between electricity and magnetism and applications of electromagnetism and electromagnetic induction (e.g., motors, generators, transformers)
- identifying the processes involved in the transformation of mechanical energy into electrical energy and the transmission of electrical energy

## **CHARACTERISTICS OF SCIENCE**

### **0017 Understand the characteristics of scientific knowledge and the process of scientific inquiry.**

For example:

- demonstrating knowledge of the nature, purpose, and characteristics of science (e.g., reliance on verifiable evidence) and the limitations of science in terms of the kinds of questions that can be answered
- recognizing the dynamic nature of scientific knowledge through the continual testing, revision, and occasional rejection of existing theories
- determining an appropriate scientific hypothesis or investigative design for addressing a given problem
- demonstrating knowledge of the principles and procedures for designing and carrying out scientific investigations (e.g., changing one variable at a time)
- recognizing the importance of and strategies for avoiding bias in scientific investigations

### **0018 Understand scientific tools, instruments, materials, and safety practices.**

For example:

- recognizing procedures for the safe and proper use of scientific tools, instruments, chemicals, and other materials in investigations
- identifying appropriate tools and units for measuring objects or substances
- identifying potential safety hazards associated with scientific equipment, materials, procedures, and settings
- demonstrating knowledge of procedures for the ethical use and care of living organisms in scientific research
- recognizing appropriate protocols for maintaining safety and for responding to emergencies during classroom laboratory activities

**0019 Understand scientific communication and the skills and procedures for analyzing data.**

For example:

- recognizing the concepts of precision, accuracy, and error and identifying potential sources of error in gathering and recording data
- applying appropriate mathematical concepts and computational skills to analyze data (e.g., using ratios; determining mean, median, and mode)
- identifying appropriate methods (e.g., using tables, graphs) and criteria for organizing data to aid in the analysis of data (e.g., detecting patterns)
- demonstrating knowledge of the use of data to support or challenge scientific arguments and claims
- identifying appropriate methods for communicating the outcomes of scientific investigations (e.g., publication in peer-reviewed journals)
- demonstrating familiarity with effective and valid resources, applying strategies for reading to gain information about science-related topics, and developing subject-area vocabulary

**0020 Understand the unifying concepts of science and technology.**

For example:

- demonstrating knowledge of the unifying concepts (e.g., system, model, change, scale) of science and technology
- recognizing the characteristics of systems, how the components of a system interact (e.g., negative and positive feedback), and how different systems interact with one another
- identifying types and characteristics of models used in science and technology and the advantages and limitations of models