Georgia Assessments for the Certification of Educators®

TEST DESIGN AND FRAMEWORK

TEST DESIGN

Physics

The **Physics** assessment consists of **two tests**. Each test contains a section with selected-response questions and a section with a constructed-response assignment. 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 030)

Subareas:	Objectives	Approximate Number of Selected-Response Questions	Constructed-Response Assignments
➢ Mechanics	0001–0004	17	1
➢ Waves and Thermal Energy	0005–0007	13	
	TOTAL	**30**	**1**
	Percentage of Test Score	**90%**	**10%**

Test II (Test Code 031)

Subareas:	Objectives	Approximate Number of Selected-Response Questions	Constructed-Response Assignments
➢ Electricity, Magnetism, and Atomic Physics	0008–0011	20	
➢ Characteristics of Science	0012–0013	10	1
	TOTAL	**30**	**1**
	Percentage of Test Score	**90%**	**10%**

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TEST DESIGN AND FRAMEWORK

TEST FRAMEWORK

Physics

MECHANICS

0001 Understand motion in one and two dimensions.

For example:

- calculating displacement, average velocity, instantaneous velocity, and acceleration in a given frame of reference
- solving problems involving displacement, time, velocity, and constant acceleration
- interpreting algebraically and graphically relationships among position, velocity, acceleration, and time
- analyzing problems involving motion in two dimensions (e.g., uniform circular motion, projectile motion)
- analyzing properties of vectors (e.g., magnitude, direction, components) and solving problems involving vector quantities analytically and graphically

0002 Understand Newton's laws of motion and the universal law of gravitation.

For example:

- analyzing examples of Newton's laws of motion in daily life
- applying knowledge of free-body diagrams and vector properties to solve problems involving multiple forces in one and two dimensions
- analyzing and solving problems involving frictional forces and coefficients (e.g., static, kinetic)
- solving problems involving gravitational forces
- applying knowledge of Newton's laws of motion to solve problems in one and two dimensions
- solving problems involving torque and static equilibrium

0003 Understand the conservation of energy.

For example:

- calculating the kinetic and potential energy of mechanical systems (e.g., object in free fall, mass on a spring, orbiting satellite or planet)
- applying knowledge of the law of conservation of energy and the work-energy theorem to solve problems involving conservative and nonconservative forces
- analyzing mechanical systems in terms of work, power, and energy

0004 Understand momentum and its conservation.

For example:

- applying knowledge of the concept of impulse and the conservation of momentum to solve problems in one and two dimensions
- applying knowledge of the concepts of energy and momentum to analyze elastic and inelastic collisions
- applying knowledge of vectors to solve momentum problems
- analyzing examples of conservation of angular momentum in everyday life

WAVES AND THERMAL ENERGY

0005 Understand characteristics of mechanical waves.

For example:

- analyzing models of harmonic motion (e.g., mass on a spring, pendulum)
- analyzing the production and propagation of sound waves
- analyzing reflection and transmission of mechanical waves
- applying knowledge of the superposition principle to solve problems involving constructive and destructive interference
- analyzing waves and solving problems involving amplitude, wavelength, period, frequency, and propagation speed in various media

0006 Understand the fundamental principles of light and optics.

For example:

- analyzing properties of images produced by various mirrors
- applying knowledge of ray diagrams and Snell's law to solve problems involving refraction
- analyzing properties of images produced by convex and concave lenses
- analyzing the phenomena of dispersion, diffraction, and polarization
- analyzing wave properties of the electromagnetic spectrum

0007 Understand the principles of thermodynamics.

For example:

- differentiating between thermal energy and temperature and solving problems involving thermal energy (e.g., thermal expansion, specific heat, internal energy)
- identifying methods of thermal energy transfer (i.e., conduction, convection, and radiation)
- applying knowledge of thermodynamic work and the law of conservation of energy to solve a variety of problems
- demonstrating knowledge of the second law of thermodynamics
- analyzing the states of matter and energy transformations during phase changes

ELECTRICITY, MAGNETISM, AND ATOMIC PHYSICS

0008 Understand electric charge and interactions between charged objects.

For example:

- demonstrating knowledge of principles and applications of electrostatics (e.g., conservation of charge, charging by induction)
- solving problems using Coulomb's law
- demonstrating knowledge of the electric field in the vicinity of point charges
- solving basic problems involving electrostatic potential and electrostatic potential energy

0009 Understand magnets, magnetic fields, and electromagnetic induction.

For example:

- demonstrating knowledge of the properties of permanent magnets
- determining the strength and orientation of the magnetic field near a current-carrying wire
- solving problems involving charged particles moving through a magnetic field
- demonstrating knowledge of direction and relative magnitude of an induced EMF in a conductor
- analyzing applications of electromagnetism (e.g., transformers, inductors, motors, generators)
- demonstrating knowledge of the generation of electromagnetic waves and their applications (e.g., radio transmitters)

0010 Understand properties of electric circuits.

For example:

- interpreting simple schematic diagrams of DC circuits
- analyzing series and parallel circuits using Ohm's law
- demonstrating knowledge of energy conservation in simple circuits
- differentiating between alternating and direct current circuits

0011 Understand the basic processes of atomic and nuclear physics.

For example:

- analyzing differences between fission and fusion and the applications of each
- demonstrating knowledge of models of nuclear and subatomic structures and behaviors (e.g., spontaneous nuclear reactions)
- demonstrating knowledge of the half-life of radioactive isotopes
- demonstrating knowledge of how the basic principles of quantum mechanics can be used to describe the properties of light and matter (e.g., Bohr model, energy of a photon)

CHARACTERISTICS OF SCIENCE

0012 Understand the characteristics of scientific knowledge and the process of scientific inquiry.

For example:

- demonstrating knowledge of the nature, purposes, 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

0013 Understand the collection, analysis, and communication of scientific data.

For example:

- identifying appropriate tools and units for measuring objects or substances
- recognizing potential safety hazards and procedures for the safe and proper use of scientific tools, instruments, chemicals, and other materials in investigations
- recognizing the concepts of precision, accuracy, and error and identifying potential sources of error in gathering and recording data
- identifying methods (e.g., appropriate mathematical concepts, tables, graphs) and criteria for organizing and analyzing data
- identifying appropriate methods for communicating the outcomes of scientific investigations (e.g., publication in peer-reviewed journals)
- demonstrating familiarity with effective resources and strategies for reading (e.g., graphic organizers) to gain information about science-related topics and developing subject-area vocabulary