Georgia End-Of-Course Tests

Content Descriptions

Based on the Georgia Performance Standards

Physical Science

Dr. John D. Barge, State School Superintendent
"Making Education Work for All Georgians"

Introduction

The State Board of Education is required by Georgia law (A+ Educational Reform Act of 2000, O.C.G.A. §20-2-281) to adopt End-of-Course Tests (EOCT) designed to measure student achievement in core subjects in grades nine through twelve. With educator input and State Board of Education approval, eight content areas were designated in 2001 to be tested. The Georgia Performance Standards (GPS) were adopted by the State Board of Education in July 2004, and the Physical Science EOCT was developed based on these standards.

Program Purpose

The EOCT are designed to improve student achievement by assessing student performance on the standards specific to each course tested. Student performance on each EOCT is provided to schools for diagnostic and remedial use. These results are used to help make instruction more effective and to ensure that all Georgia students have access to a rigorous curriculum that meets high academic standards. These results are also used for student accountability and to gauge the quality of education in the state. The EOCT are the final exams for each EOCT course. For students in grade 10 or above beginning the 2011-2012 school year, the final grade in each course is calculated by weighing the course grade 85% and the EOCT score 15%. For students in grade 9 beginning the 2011-2012 school year and later, the final grade in each course is calculated by weighing the course grade 80% and the EOCT score 20% (State Board Rule 160-4-2-.13). The student must have a final grade of at least 70 to pass the course and to earn credit toward graduation.

EOCT Content Descriptions

The EOCT Content Descriptions are provided to acquaint Georgia educators with the content coverage of the EOCT. Only the knowledge, concepts, and skills addressed in the GPS are assessed on the EOCT. Committees of Georgia educators reviewed the curriculum and provided guidance for the assessment program.

It is important to note that some curricular standards are better suited for classroom or individual assessment rather than large-scale, summative assessment. While those curricular standards designed for classroom/individual assessment are not included in the Content Descriptions, the knowledge, concepts, and skills outlined are often required for the mastery of the standards that are assessed. Therefore, the EOCT Content Descriptions are in *no way* intended to substitute for the GPS; they are provided to help educators better understand how the curriculum will be assessed. Further, the EOCT Content Descriptions *by no means* suggest *when* concepts and skills should be introduced in the instructional sequence; rather, their purpose is to communicate when concepts and skills will be assessed on the EOCT. Georgia law requires educators to teach the standards set forth in the state-adopted curriculum (i.e., the GPS). The GPS are located at www.georgiastandards.org.

Physical Science Domains

In order to provide reliable measures of student achievement, as well as to give structure to the assessment program, the content standards contained in the GPS were grouped into content domains. Each domain was created by combining standards that share similar content characteristics. Four domains were identified for Physical Science:

- Chemistry: Atomic and Nuclear Theory and the Periodic Table
  Assessment in this domain focuses on describing basic atomic structure relating the number; identifying isotopes and location of subatomic particles to chemical activity and periodic trends; describing element placement on the Periodic Table and related trends in chemical activity; differentiating between radioactive particles and rays; describing radioactivity and its importance; identifying phases based on molecular motion; interpreting properties from data collected in a laboratory setting.

- Chemistry: Chemical Reactions and Properties of Matter
  Assessment in this domain focuses on naming, writing, and classifying chemical formulas and compounds; balancing equations and identifying chemical reactions; naming compounds and formulas; demonstrating the Law of Conservation of Matter; calculating density.

- Physics: Energy, Force, and Motion
  Assessment in this domain focuses on identifying energy transformations; identifying and analyzing the transfer of heat energy by conduction, convection, and radiation; interpreting a phase diagram; describing and calculating velocity and acceleration; comparing Newton's three laws; calculating mechanical advantage; understanding the work of simple machines.

- Physics: Waves, Electricity, and Magnetism
  Assessment in this domain focuses on recognizing all waves transfer energy; investigating light and sound phenomena and comparing light to sound; explaining the Doppler effect; describing the causes of static electricity; constructing and analyzing series and parallel circuits; describing the relationship between voltage, current, and resistance; relating electricity and magnetism and common applications.

Characteristics of Science

The GPS in science requires that content be taught in conjunction with process skills identified as the Characteristics of Science. Characteristics of Science refers to the process skills used in the learning and practice of science, such as testing a hypothesis, record keeping, using correct safety procedures, using appropriate tools and instruments, applying math and technology, analyzing data, interpreting results, and communicating scientific information. It also refers to understanding how science knowledge grows and changes and the processes that drive those changes.

The concepts and skills inherent in Characteristics of Science are integrated in items across the four content domains.

Overview of the Characteristics of Science

- Students will understand and apply the skills and knowledge needed to conduct and interpret scientific experiments, including safety as applied to specific biological situations, including:
  - using appropriate metric measurements
  - understanding types of variables in an experiment
  - assessing the validity of methods for collecting, graphing, analyzing, and interpreting data
  - evaluating experimental designs for their intended outcome
  - determining the appropriate display and use of data from an experiment
  - distinguishing between qualitative and quantitative data
  - recognizing the relationship between accuracy and precision in scientific investigations
  - evaluating safe and unsafe lab practices
  - synthesizing scientific inferences based on the information provided
  - constructing appropriate conclusions based on experimental data
  - solving simple problems using equations or dimensional analysis
  - compiling evidence from multiple sources to form conclusions that are coherent and scientifically defendable
  - analyzing discrepancies in recorded data and conclude possible sources of the error
  - understanding the ever-changing nature of science and how scientific views of universal principles may change as additional data becomes available
  - understanding that experimental conclusions often lead to additional questions and investigations

Associated GPS Standards

SCSh1 through SCSh8 within content from SPS1 through SPS10

Physical Science
Domain: Chemistry – Atomic and Nuclear Theory and the Periodic Table

Overview of the Domain

- Students will investigate our current understanding of the atom.
  - Students will examine the structure of the atom.
  - Students will compare and contrast ionic and covalent bonds in terms of electron movement.
- Students will distinguish the characteristics and components of radioactivity.
  - Students will differentiate between alpha and beta particles and gamma radiation.
  - Students will differentiate between fission and fusion.
  - Students will explain the process of half-life as related to radioactive decay.
  - Students will evaluate the practical applications of nuclear energy, as well as evaluate the potential problems associated with nuclear energy.
- Students will investigate the arrangement of the Periodic Table.
  - Students will determine general trends including the number of valence electrons, types of ions formed by representative elements, location of metals, nonmetals, and metalloids, and the state of matter at room temperature.
  - Students will use the Periodic Table to predict properties for representative elements using the periodic trends.
- Students will compare and contrast the phases of matter as they relate to atomic and molecular motion.
  - Students will compare and contrast the atomic/molecular motion of solids, liquids, gases, and plasmas.
  - Students will relate temperature, pressure, and volume of gases to the behavior of gases.

Associated GPS Standards

SPS1 SPS3 SPS4 SPS5

Associated GPS Concepts and Skills

Assessment of this domain will focus on the following:

- recognizing the main ideas connected to atomic structure
  - understanding the relative size, location, and charge of protons, neutrons, and electrons in an atom
  - locating information in the Periodic Table to predict the structure of an atom
  - finding the symbol, atomic number, or atomic mass given the name of an element
  - recognizing isotopes of the same atom
  - selecting and distinguishing between atoms, molecules, and ions
  - calculating the charge on an atom or ion based on number of protons and electrons in an atom
- applying the basic concepts of radioactivity and nuclear reactions
  - differentiating between the three main forms of radioactive decay (alpha, beta, and gamma) and the characteristics of each form of radiation

  - demonstrating a qualitative understanding of the processes of fission and fusion
  - relating the half-life and other properties of elements (e.g., radon, plutonium) and isotopes (e.g., iodine 131) to their importance in everyday life
  - comparing the practical application to the potential dangers of nuclear energy
- understanding the value of using the Periodic Table to determine properties of atoms
  - determining the number of outer shell electrons for the first 20 elements
  - relating the most likely valence state(s) for an element (excluding transition elements) to its group
  - relating the number of outer shell electrons to reactivity (i.e., how many electrons would typically be lost, gained, or shared)
  - comparing the characteristics of a neutral atom to that of an ion
  - identifying an element as a metal, metalloid, or nonmetal
  - relating reactivity to vertical location in a family
- comprehending the relationship between molecular motion and phases of matter
  - recognizing characteristics of matter related to its state
  - interpreting properties of matter at the atomic level
  - determining the relationship between the temperature, volume, and pressure of a gas

Physical Science
Domain: Chemistry – Chemical Reactions and Properties of Matter

Overview of the Domain

- Students will explore the nature of matter, its classifications, and the system for naming types of matter.
  - Students will calculate density after determining the mass and volume of a substance.
  - Students will predict formulas for stable binary ionic compounds based on balance of charges.
  - Students will use IUPAC nomenclature properly in naming compounds and in comparing chemical names to chemical formulas.
  - Students will demonstrate the Law of Conservation of Matter in a chemical reaction.
  - Students will apply the Law of Conservation of Matter when identifying and balancing equations.
- Students will investigate the properties of solutions.
  - Students will describe solutions in terms of solute/solvent, conductivity, and concentration.
  - Students will explore factors that affect the rate a solute dissolves within a solvent.
  - Students will demonstrate that solubility is related to temperature by constructing a solubility curve.
  - Students will compare and contrast the components and properties of acids and bases.
  - Students will determine whether common household substances are acidic, basic, or neutral.

Associated GPS Standards

SPS2 SPS6

Associated GPS Concepts and Skills

Assessment of this domain will focus on the following:

- identifying appropriate units for physical properties such as mass, volume, and density
- solving quantitative problems involving physical properties such as mass, volume, and density for objects in the student's environment
- recognizing the correct formula and name for the compound formed when two elements react
- distinguishing the correct formula for ionic binary compounds and diatomic molecules
- determining whether simple binary compounds are ionic or covalent based on the location of the constituent elements on the Periodic Table
- relating the correct formulas to binary compounds and diatomic molecules
- naming compounds using the IUPAC system of nomenclature
- balancing equations and identifying types of reactions
- selecting the type of a reaction as being a synthesis, decomposition, single displacement, or double displacement reaction
- differentiating the solute from the solvent within a solution
- understanding that different compounds placed in solution will affect the conductivity of the solution

- comparing concentrations of solutions
- differentiating between saturated and unsaturated solutions
- exploring factors that affect the rates of dissolving within a solution
- constructing solubility curves to demonstrate how temperature can affect the solubility of a solution
- comparing the properties of an acid to those of a base
- generalizing about the chemistry of an acid or a base
- distinguishing between the pH of household acids and bases

Physical Science
Domain: Physics – Energy, Force, and Motion

Overview of the Domain

- Students will relate transformations and flow of energy within a system.
  - Students will compare energy transformations within a system (e.g., lighting of a match).
  - Students will investigate molecular motion as it relates to thermal energy changes.
  - Students will differentiate between conduction, convection, and radiation.
  - Students will determine the heat lost or gained by a substance using mass, specific heat capacity, and temperature.
  - Students will explain the flow of energy in phase changes through the use of a phase diagram.
- Students will determine relationships among force, mass, and motion.
  - Students will calculate velocity and acceleration.
  - Students will apply Newton's three laws to everyday situations.
  - Students will evaluate the gravitational force on falling objects.
  - Students will explain the difference in mass and weight.
  - Students will calculate amounts of work and mechanical advantage when using a simple machine.

Associated GPS Standards

SPS7 SPS8

Associated GPS Concepts and Skills

Assessment of this domain will focus on the following:

- understanding sources and uses of energy such as chemical, mechanical, thermonuclear, photoelectric, and electromagnetic
- understanding and application of energy conversion and heat transfer
- comparing rates of heat transfer based on a change of one variable in a situation involving conduction
- calculating the heat lost or gained in a system
- calculating the specific heat capacity of a substance
- using a phase diagram to clarify the transfer of energy
- distinguishing the relationships and differences between velocity and acceleration
- calculating mass, acceleration, or an unbalanced force given two values
- determining the result of unbalanced forces
- recognizing forces, including various forms of friction
- evaluating forces when the motion is constant
- differentiating between mass and weight
- calculating work when provided the force and the distance moved
- analyzing the simple machines qualitatively and quantitatively in terms of force, distance, work, and mechanical advantage

Physical Science
Domain: Physics – Waves, Electricity, and Magnetism

Overview of the Domain

- Students will investigate the properties of waves.
  - Students will recognize that all waves transfer energy.
  - Students will relate frequency and wavelength to the energy of different types of electromagnetic waves and mechanical waves.
  - Students will compare and contrast the characteristics of electromagnetic and mechanical (sound) waves.
  - Students will investigate the phenomena of reflection, refraction, interference, and diffraction.
  - Students will compare the speed of sound of the Doppler effect and explain the Doppler effect in terms of everyday interactions.
- Students will investigate the properties of electricity and magnetism.
  - Students will investigate static electricity in terms of friction, induction, and conduction.
  - Students will explain the flow of electrons in series and parallel circuits, alternating and direct current, and understanding the relationship among voltage, resistance, and current.
  - Students will investigate applications of magnetism and/or its relationship to the movement of electrical charge as it relates to electromagnets, simple motors, and permanent magnets.

Associated GPS Standards

SPS9 SPS10

Associated GPS Concepts and Skills

Assessment of this domain will focus on the following:

- recognizing the relation of frequency and energy in electromagnetic and mechanical waves
- evaluating a wave for the energy transferred
- relating color to frequency of light
- comparing and explaining general wave interactions
- relating the speed of sound to characteristics of the medium
- relating properties of sound to aspects of the student's world (e.g., pitch, Doppler effect)
- distinguishing charges and forces in static electricity situations
- determining the source of static electricity
- observing charge by conduction and induction
- analyzing static electricity
- comparing methods of generating static electricity
- evaluating the current within series and parallel circuits
- discovering electric and magnetic interactions in laboratory and technology applications such as motors and generators