

Excellence as the Standard

Enhancing Student Success

On FCAT Science

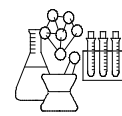


High School

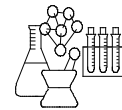


Brevard Public Schools
Dr. Richard DiPatri, Superintendent
Summer 2001

WHY?



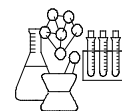
In order to ensure that Florida students are prepared for the future, the Department of Education has developed subject area guides known as the Sunshine State Standards. These instructional benchmarks specify what students should know and be able to do as they complete each phase of their education.



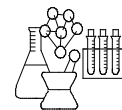
The Florida Comprehensive Assessment Test (FCAT) is designed to assess student performance relative to the Sunshine State Standards. Just as classroom teachers periodically assess their own students, the state will periodically assess all students.



FCAT Science assessment will focus on science concepts, processes, and broad science knowledge, rather than on isolated facts, to assure that Florida students are prepared to thrive in a world shaped by science and technology.



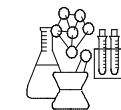
Regular assessment of student performance will provide feedback to help determine how well our goals are being accomplished and allow continuing success.



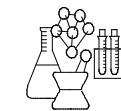
FCAT Science will not add instructional standards to the curriculum, but will measure and report how well students are accomplishing the existing standards.

“Classroom labs and activities that support instruction in the Sunshine State Standards are necessary for students to develop and apply the skills assessed on FCAT Science.”
Florida D.O.E., May 2001

What to Expect



FCAT Science will follow the same style as the Reading and Mathematics sections. Items will be **challenging** and based on **applied science**. Graphics, data, and short science passages will be incorporated.



The test will include multiple choice, gridded response, short response, and extended response items. Gridded response items (for grades 8 and 10) will be used for answering numerical science questions. **Scientific understanding**, rather than mathematical proficiency, will be emphasized. Therefore numerical scientific questions **will not** require the use of a calculator, although students will have access to calculators during the assessment.

“Inquiry not only tests what students know, it presses students to put what they know to the test.”
John Glenn, U.S. Senator, Astronaut, 2000

What It Covers

The test will assess four major science areas called **Clusters**. These clusters comprise the eight major scientific themes or concepts, known as **Strands**. Each cluster is weighted equally.

Cluster 1

Physical and Chemical Sciences 25%

Strand A: The Nature of Matter
Strand B: Energy
Strand C: Force and Motion

Cluster 2

Earth and Space Sciences 25%

Strand D: Processes that Shape the Earth
Strand E: Earth and Space

Cluster 3

Life and Environmental Sciences 25%

Strand F: Processes of Life
Strand G: How Living Things Interact with Their Environment

Cluster 4

Scientific Thinking 25%

Strand H: The Nature of Science

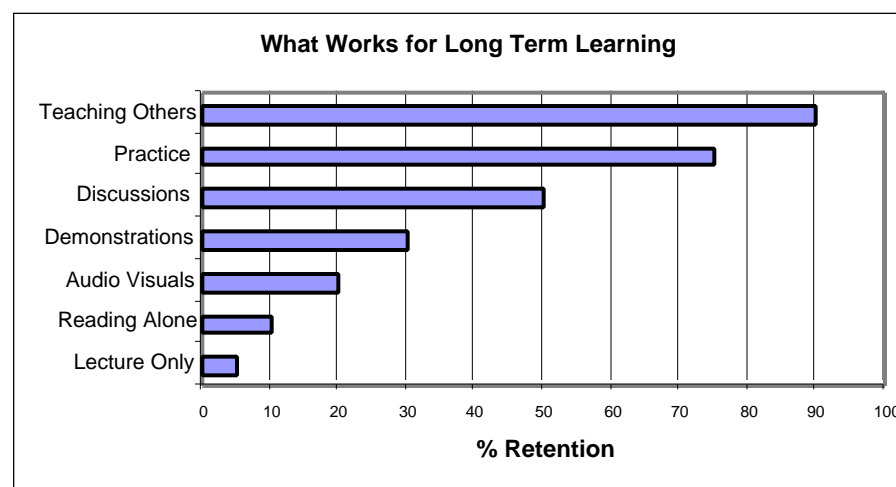
Each *Strand* is composed of *Standards* which are, in turn, described by specific *Benchmarks*. FCAT Science test items are closely linked to these benchmarks (*listed inside this brochure*). **Certain benchmarks will be tested annually, while others will be evaluated at least once every three years.**

How to Get There

Keys to Success

- Emphasize the relevance of science. Relate science to daily life and encourage students to connect their own experiences to science.
- Involve students in sustained, in-depth projects rather than just covering the textbook. Engage students in unifying topics that can be fully explored.
- Actively engage students in scientific processes and inquiry.
- Provide opportunities for hands-on activities and investigations that involve collecting, manipulating, analyzing, and interpreting data.
- Encourage students to make oral presentations, participate in class discussions, keep journals, and construct graphs.
- Use a variety of meaningful classroom assessments.

A minimum of **40%** of science instructional time should be devoted to investigative science activities for high school students.
(NSTA)



Internet Resources:

Sunshine State Standards & FCAT:
<http://www.firn.edu/doe/menu/sss.htm>

Sunshine State Standards K-12 WebLinks
Database: <http://www.itrc.ucf.edu/k12db/>

For More Information Contact:
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A **student** having a grievance concerning discrimination may contact: Ms. Marjorie Ebersbach, Equity Coordinator, Assistant Superintendent, Division of Curriculum and Instruction; Dr. Walter Christy, Director of Secondary Education; or Ms. Eva Lewis, ADA/Section 504 Coordinator, at (321) 631-1911.

A **employee** or **applicant** having a grievance concerning employment may contact: Mr. Leroy Berry, Deputy Superintendent, Human Resources Services, Ms. Ann-Marie Brush, Director, Human Resources, or Ms. Eva Lewis, ADA/Section 504 Coordinator, at (321) 631-1911.

This publication or portions of this publication can be made available to persons with disabilities in a variety of formats, including large print, Braille, or audiotape. Telephone or written requests should include your name, address, and telephone number. Requests should be made to Kim Riddle, Exceptional Education Projects, 631-1911, extension 535, at least two (2) weeks prior to the time you need the publication.

High School Science Benchmarks

Strand A: The Nature of Matter	
1. The student understands that all matter has observable, measurable properties.	
SC.A.1.4.1 The student knows that the electron configuration in atoms determines how a substance reacts and how much energy is involved in its reactions. Assessed in 3 Year Cycles	Multiple Choice Gridded Response
SC.A.1.4.2 The student knows that the vast diversity of the properties of materials is primarily due to variations in the forces that hold molecules together. Assessed in 3 Year Cycles (Also assesses A.1.4.5)	Multiple Choice
SC.A.1.4.3 The student knows that a change from one phase of matter to another involves a gain or loss of energy. Assessed in 3 Year Cycles	Multiple Choice Gridded Response
SC.A.1.4.4 The student experiments and determines that the rates of reaction among atoms and molecules depend on the concentration, pressure, and temperature of the reactants and the presence or absence of catalysts. Annually Assessed	Multiple Choice Short Response Gridded Response
SC.A.1.4.5 The student knows that connections (bonds) form between substances when outer-shell electrons are either transferred or shared between their atoms, changing the properties of substances. (Assessed as A.1.4.2)	
2. The student understands the basic principles of atomic theory.	
SC.A.2.4.1 The student knows that the number and configuration of electrons will equal the number of protons in an electrically neutral atom and when an atom gains or loses electrons, the charge is unbalanced. Assessed in 3 Year Cycles	Multiple Choice Gridded Response
SC.A.2.4.2 The student knows the difference between an element, a molecule, and a compound. Assessed in 3 Year Cycles	Multiple Choice
SC.A.2.4.3 The student knows that a number of elements have heavier, unstable nuclei that decay, spontaneously giving off smaller particles and waves that result in a small loss of mass and release a large amount of energy. Assessed in 3 Year Cycles (Also assesses A.2.4.4)	Multiple Choice
SC.A.2.4.4 The student knows that nuclear energy is released when small, light atoms are fused into heavier ones. (Assessed as A.2.4.3)	
SC.A.2.4.5 The student knows that elements are arranged into groups and families based on similarities in electron structure and that their physical and chemical properties can be predicted. Annually Assessed	Multiple Choice
SC.A.2.4.6 The student understands that matter may act as a wave, a particle, or something else entirely different with its own characteristic behavior. Assessed in 3 Year Cycles	Multiple Choice

Strand B: Energy	
1. The student recognizes that energy may be changed in form with varying efficiency	
SC.B.1.4.1 The student understands how knowledge of energy is fundamental to all the scientific disciplines (e.g., the energy required for biological processes in living organisms and the energy required for the building, erosion, and rebuilding of the Earth). Annually Assessed	Multiple Choice Short Response Gridded Response
SC.B.1.4.2 The student understands that there is conservation of mass and energy when matter is transformed. Assessed in 3 Year Cycles	Multiple Choice Gridded Response
SC.B.1.4.3 The student knows that temperature is a measure of the average translational kinetic energy of motion of the molecules in an object. Assessed in 3 Year Cycles	Multiple Choice Gridded Response
SC.B.1.4.4 The student knows that as electrical charges oscillate, they create time-varying electric and magnetic fields that propagate away from the source as an electromagnetic wave. Assessed in 3 Year Cycles	Multiple Choice Gridded Response
SC.B.1.4.5 The student knows that each source of energy presents advantages and disadvantages to its use in society (e.g., political and economic implications may determine a society's selection of renewable or nonrenewable energy sources). (Assessed as G.2.4.2)	
SC.B.1.4.6 The student knows that the first law of thermodynamics relates the transfer of energy to the work done and the heat transferred. (Assessed as B.1.4.7)	
SC.B.1.4.7 The student knows that the total amount of usable energy always decreases, even though the total amount of energy is conserved in any transfer. Assessed in 3 Year Cycles	Gridded Response Multiple Choice
(Also assesses B.1.4.6)	
2. The student understands the interaction of matter and energy.	
SC.B.2.4.1 The student knows that the structure of the universe is the result of interactions involving fundamental particles (matter) and basic forces (energy) and that evidence suggests that the universe contains all of the matter and energy that ever existed. Assessed in 3 Year Cycles	Multiple Choice

Strand C: Force and Motion	
1. The student understands that types of motion may be described, measured, and predicted.	
SC.C.1.4.1 The student knows that all motion is relative to whatever frame of reference is chosen and that there is no absolute frame of reference from which to observe all motion. Assessed in 3 Year Cycles	Multiple Choice Gridded Response
SC.C.1.4.2 The student knows that any change in velocity is an acceleration. Assessed in 3 Year Cycles	Multiple Choice Gridded Response
2. The student understands that the types of force that act on an object and the effect of that force can be described, measured, and predicted.	
SC.C.2.4.1 The student knows that acceleration due to gravitational force is proportional to mass and inversely proportional to the square of the distance between the objects. Annually Assessed	Multiple Choice Gridded Response
SC.C.2.4.2 The student knows that electrical forces exist between any two charged objects. (Assessed as C.2.4.3)	
SC.C.2.4.3 The student describes how magnetic force and electrical force are two aspects of a single force. Assessed in 3 Year Cycles (Also assesses C.2.4.2)	Multiple Choice
SC.C.2.4.4 The student knows that the forces that hold the nucleus of an atom together are much stronger than electromagnetic force and that this is the reason for the great amount of energy released from the nuclear reactions in the sun and other stars. Assessed in 3 Year Cycles	Multiple Choice
SC.C.2.4.5 The student knows that most observable forces can be traced to electric forces acting between atoms or molecules. Assessed in 3 Year Cycles	Multiple Choice
SC.C.2.4.6 The student explains that all forces come in pairs commonly called action and reaction. Assessed in 3 Year Cycles	Multiple Choice

Strand D: Processes that Shape the Earth	
1. The student recognizes the processes in the lithosphere, atmosphere, hydrosphere, and biosphere interact to shape the Earth.	
SC.D.1.4.1 The student knows how climatic patterns on Earth result from an interplay of many factors (Earth's topography, its rotation on its axis, solar radiation, the transfer of heat energy where the atmosphere interfaces with lands and oceans, and wind and ocean currents). Annually Assessed	Multiple Choice Short Response
SC.D.1.4.2 The student knows that the solid crust of Earth consists of slow-moving, separate plates that float on a denser, molten layer of Earth and that these plates interact with each other, changing the Earth's surface in many ways (e.g., forming mountain ranges and rift valleys, causing earthquake and volcanic activity, and forming undersea mountains that can become ocean islands). Annually Assessed	Multiple Choice Short Response
SC.D.1.4.3 The student knows that changes in Earth's climate, geological activity, and life forms may be traced and compared. Assessed in 3 Year Cycles	Multiple Choice
SC.D.1.4.4 The student knows that Earth's systems and organisms are the result of a long, continuous change over time. (Assessed as F.2.4.3)	
2. The student understands the need for protection of the natural systems on Earth.	
SC.D.2.4.1 The student understands the interconnectedness of the systems on Earth and the quality of life. Annually Assessed	Short Response Multiple Choice
(Also assesses G.2.4.4)	

Strand E: Earth and Space	
1. The student understands the interaction and organization in the Solar System and the Universe and how this affects life on Earth.	
SC.E.1.4.1 The student understands the relationships between events on Earth and the movements of the Earth, its moon, the other planets, and the sun. Annually Assessed	Multiple Choice Short Response
(Also assesses E.1.4.2, E.1.4.3)	
SC.E.1.4.2 The student knows how the characteristics of other planets and satellites are similar to and different from those of the Earth. (Assessed as E.1.4.1)	
SC.E.1.4.3 The student knows the various reasons that Earth is the only planet in our Solar System that appears to be capable of supporting life as we know it. (Assessed as E.1.4.1)	
2. The student recognizes the vastness of the Universe and the Earth’s place in it.	
SC.E.2.4.1 The student knows that the stages in the development of three categories of stars are based on mass: stars that have the approximate mass of our sun, stars that are two- to three-stellar masses and develop into neutron stars, and stars that are five- to six-stellar masses and develop into black holes. Assessed in 3 Year Cycles	
Multiple Choice	
SC.E.2.4.2 The student identifies the arrangement of bodies found within and outside our galaxy. Assessed in 3 Year Cycles	
Multiple Choice	
SC.E.2.4.3 The student knows astronomical distance and time. Assessed in 3 Year Cycles	
Multiple Choice Gridded Response	
SC.E.2.4.4 The student understands stellar equilibrium. (Not assessed)	
SC.E.2.4.5 The student knows various scientific theories on how the universe was formed. (Not assessed)	
SC.E.2.4.6 The student knows the various ways in which scientists collect and generate data about our universe (e.g., X-ray telescopes, computer simulations of gravitational systems, nuclear reactions, space probes, and supercollider simulations). (Assessed as H.1.4.1)	
SC.E.2.4.7 The student knows that mathematical models and computer simulations are used in studying evidence from many sources to form a scientific account of the universe. (Assessed as H.1.4.1)	

Strand F: Processes of Life	
1. The student describes patterns of structure and function in living things.	
SC.F.1.4.1 The student knows that the body processes involve specific biochemical reactions governed by biochemical principles. Annually Assessed	Multiple Choice Short Response Gridded Response
(Also assesses F.1.4.3, F.1.4.5)	
SC.F.1.4.2 The student knows that body structures are uniquely designed and adapted for their function. (Assessed as F.2.4.3)	
SC.F.1.4.3 The student knows that membranes are sites for chemical synthesis and essential energy conversions. (Assessed as F.1.4.1)	
SC.F.1.4.4 The student understands that biological systems obey the same laws of conservation as physical systems. Assessed in 3 Year Cycles	
Multiple Choice	
SC.F.1.4.5 The student knows that complex interactions among the different kinds of molecules in the cell cause distinct cycles of activity governed by proteins. (Assessed as F.1.4.1)	
SC.F.1.4.6 The student knows that separate parts of the body communicate with each other using electrical and/or chemical signals. (Assessed as F.1.4.7)	
SC.F.1.4.7 The student knows that organisms respond to internal and external stimuli. Assessed in 3 Year Cycles	
Multiple Choice	
(Also assesses F.1.4.6, F.1.4.8)	
SC.F.1.4.8 The student knows that cell behavior can be affected by molecules from other parts of the organism or even from other organisms. (Assessed as F.1.4.7)	
2. The student understands the process and importance of genetic diversity.	
SC.F.2.4.1 The student understands the mechanisms of asexual and sexual reproduction and knows the different genetic advantages and disadvantages of asexual and sexual reproduction. Assessed in 3 Year Cycles	
Multiple Choice Gridded Response	
SC.F.2.4.2 The student knows that every cell contains a “blueprint” coded in DNA molecules that specify how proteins are assembled to regulate cells. Assessed in 3 Year Cycles	
Multiple Choice	
SC.F.2.4.3 The student understands the mechanisms of change (e.g., mutation and natural selection) that lead to adaptations in a species and their ability to survive naturally in changing conditions and to increase species diversity. Annually Assessed	
Multiple Choice Short Response	
(Also assesses D.1.4.4, F.1.4.2)	

Strand G: How Living Things Interact with Their Environment	
1. The student understands the competitive, interdependent, cyclic nature of living things in the environment.	
SC.G.1.4.1 The student knows of the great diversity and interdependence of living things. Annually Assessed	Multiple Choice Short Response
(Also assesses G.1.4.2)	
SC.G.1.4.2 The student understands how the flow of energy through an ecosystem made up of producers, consumers, and decomposers carries out the processes of life and that some energy dissipates as heat and is not recycled. (Assessed as G.1.4.1)	
SC.G.1.4.3 The student knows that the chemical elements that make up the molecules of living things are combined and recombined in different ways. Assessed in 3 Year Cycles	
Multiple Choice	
2. The student understands the consequences of using limited natural resources.	
SC.G.2.4.1 The student knows that layers of energy-rich organic materials have been gradually turned into great coal beds and oil pools (fossil fuels) by the pressure of the overlying earth and that humans burn fossil fuels to release the stored energy as heat and carbon dioxide. Assessed in 3 Year Cycles	
Multiple Choice	
SC.G.2.4.2 The student knows that changes in a component of an ecosystem will have unpredictable effects on the entire system but that the components of the system tend to react in a way that will restore the ecosystem to its original condition. Annually Assessed	
Multiple Choice Short Response Extended Response	
(Also assesses B.1.4.5, G.2.4.5)	
SC.G.2.4.3 The student understands how genetic variation of offspring contributes to population control in an environment and that natural selection ensures that those who are best adapted to their surroundings survive to reproduce. Assessed in 3 Year Cycles	
Multiple Choice	
SC.G.2.4.4 The student knows that the world ecosystems are shaped by physical factors that limit their productivity. (Assessed as D.2.4.1)	
SC.G.2.4.5 The student understands that the amount of life any environment can support is limited and that human activities can change the flow of energy and reduce the fertility of the Earth. (Assessed as G.2.4.2)	
SC.G.2.4.6 The student knows the ways in which humans today are placing their environmental support systems at risk(e.g., rapid human population growth, environmental degradation, and resource depletion). Assessed in 3 Year Cycles	
Multiple Choice	

Strand H: The Nature of Science	
1. The student uses the scientific processes and habits of mind to solve problems.	
SC.H.1.4.1 The student knows that investigations are conducted to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare different theories. Annually Assessed	
Multiple Choice Gridded Response Short Response Extended Response	
SC.H.1.4.2 The student knows that from time to time, major shifts occur in the scientific view of how the world works, but that more often the changes that take place in the body of scientific knowledge are small modifications of prior knowledge. Assessed in 3 Year Cycles	
Multiple Choice	
SC.H.1.4.4 The student knows that scientists in any one research group tend to see things alike and that therefore scientific teams are expected to seek out the possible sources of bias in the design of their investigations and in their data analysis. Assessed in 3 Year Cycles	
Multiple Choice	
SC.H.1.4.5 The student understands that new ideas in science are limited by the context in which they are conceived, are often rejected by the scientific establishment, sometimes spring from unexpected findings, and usually grow slowly from many contributors. Assessed in 3 Year Cycles	
Multiple Choice	
SC.H.1.4.7 The student understands the importance of a sense of responsibility, a commitment to peer review, truthful reporting of the methods and outcomes of investigations, and making the public aware of the findings. Assessed in 3 Year Cycles	
Multiple Choice	
2. The student understands that most natural events occur in comprehensible, consistent patterns.	
SC.H.2.4.1 The student knows that scientists assume that the universe is a vast system in which basic rules exist that may range from very simple to extremely complex, but that scientists operate on the belief that the rules can be discovered by careful, systemic study. Annually Assessed	
Multiple Choice	
3. The student understands that science, technology, and society are interwoven and interdependent.	
SC.H.3.4.1 The student knows that performance testing is often conducted using small-scale models, computer simulations, or analogous systems to reduce the chance of system failure. Assessed in 3 Year Cycles	
Multiple Choice	
SC.H.3.4.2 The student knows that technological problems often create a demand for new scientific knowledge and that new technologies make it possible for scientists to extend their research in a way that advances science. Annually Assessed	
Multiple Choice Short Response	
SC.H.3.4.3 The student knows that scientists can bring information, insights, and analytical skills to matters of public concern and help people understand the possible causes and effects of events. Assessed in 3 Year Cycles	
Multiple Choice	