2004

FCAT

Florida Comprehensive Assessment Test

SCIENCE
SAMPLE ANSWER KEY

GRADE

10

FC00000159

FCAT Sample Test Materials

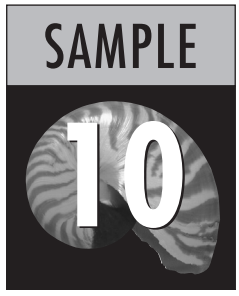
These sample test materials are designed to help students prepare to answer FCAT questions. These materials introduce them to the kinds of questions they will answer when they take FCAT and include hints for responding to the different kinds of questions. The FCAT Science sample test materials for Grade 10 are composed of the books described below:

❑ **Sample Test and Answer Book**
Includes a science sample test, a sample answer book, and instructions for completing the sample test. (Copies are available for all students in the tested grade.)

☑ **Sample Answer Key**
Includes answers and explanations for the questions in the sample test. (Copies are available for classroom teachers only.)

☑ = This book

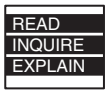
FCAT Science
Sample Answer Key



This book contains answers to the FCAT Science sample test questions. It also gives the *Sunshine State Standards* benchmark assessed by each item on the sample test. In addition, one or more possible approaches to solving the questions are provided. Students may use approaches other than these and still receive credit if they also obtain a correct answer. For multiple-choice items, the reason an answer choice is incorrect (distractor rationale) is also provided.

Multiple-choice and gridded-response items are scored by awarding one point for each correct answer. The "Read, Inquire, Explain" questions allow partial credit for some answers, even if they are not 100% correct. Answers will be scored and points will be given based on the completeness and correctness of the answers. If a portion of an answer is correct, a portion of the points may be awarded.

The scoring rubrics for the short-response questions and the extended-response questions are shown below:



Rubric for Short-Response Questions

2 points	A score of two indicates that the student has demonstrated a thorough understanding of the scientific concepts and/or procedures embodied in the task. The student has completed the task correctly, in a scientifically sound manner. When required, student explanations and/or interpretations are clear and complete. The response may contain minor flaws that do not detract from a demonstration of a thorough understanding.
1 point	A score of one indicates that the student has provided a response that is only partially correct. For example, the student may arrive at an acceptable conclusion or provide an adequate interpretation, but may demonstrate some misunderstanding of the underlying scientific concepts and/or procedures. Conversely, a student may arrive at an unacceptable conclusion or provide a faulty interpretation, but could have applied appropriate and scientifically sound concepts and/or procedures.
0 points	A score of zero indicates that the student has provided a completely incorrect solution or uninterpretable response, or no response at all.

Rubric for Extended-Response Questions

4 points — A score of four indicates that the student has demonstrated a thorough understanding of the scientific concepts and/or procedures embodied in the task. The student has completed the task correctly, used scientifically sound procedures, and provided clear and complete explanations and interpretations.

The response may contain minor flaws that do not detract from a demonstration of a thorough understanding.

3 points — A score of three indicates that the student has demonstrated an understanding of the scientific concepts and/or procedures embodied in the task. The student's response to the task is essentially correct, but the scientific procedures, explanations, and/or interpretations provided are not thorough.

The response may contain minor flaws that reflect inattentiveness or indicate some misunderstanding of the underlying scientific concepts and/or procedures.

2 points — A score of two indicates that the student has demonstrated only a partial understanding of the scientific concepts and/or procedures embodied in the task. Although the student may have arrived at an acceptable conclusion or provided an adequate interpretation of the task, the student's work lacks an essential understanding of the underlying scientific concepts and/or procedures.

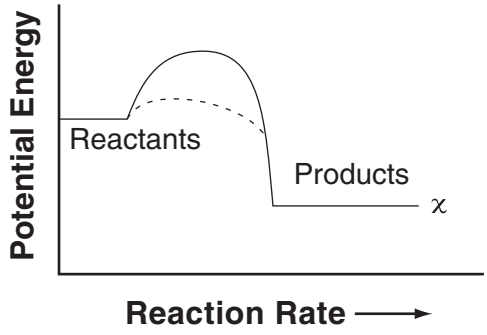
The response may contain errors related to misunderstanding important aspects of the task, misuse of scientific procedures/processes, or faulty interpretations of results.

1 point — A score of one indicates that the student has demonstrated a very limited understanding of the scientific concepts and/or procedures embodied in the task. The student's response is incomplete and exhibits many flaws. Although the student's response has addressed some of the conditions of the task, the student has reached an inadequate conclusion and/or provided reasoning that is faulty or incomplete.

The response exhibits many flaws or may be incomplete.

0 points — A score of zero indicates that the student has provided a completely incorrect solution or uninterpretable response, or no response at all.

1 **The correct answer is D (as shown below).**



Strand: A—The Nature of Matter

Benchmark: 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.

Answer Strategy:

To solve this problem the interpretation of graphs is required. Catalysts may increase the rate of reaction by requiring less activation energy for the reaction to take place. The energy contents of the reactants and the products themselves are not affected by catalysts. Only Graph D shows the same products and reactants with less energy required for the reaction to occur.

Distractor Rationale:

A. Graph A shows the potential energy levels of both products and reactants staying the same, but the catalyst is shown requiring **more** energy for the reaction.

B. Graph B shows two separate reactions each with different potential energy levels for the products and reactants.

C. Graph C also shows two separate reactions each with different potential energy levels for both products and reactants.

2 **The correct answer is F (They have one electron in their outer orbital).**

Strand: A—The Nature of Matter

Benchmark: 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.

Answer Strategy:

The solution to this problem can be found by using the periodic table. The lowest ionization potential from the graph is for elements with atomic numbers 3, 11, and 19. On the periodic table, the elements are arranged by atomic number. These three atomic numbers correspond to elements in Group 1 (the alkali metals). Each of these elements has one electron in the outer shell or orbital. Less ionization energy is required to remove this one electron.

Distractor Rationale:

G. Protons are not lost in this process. Electrons are the subatomic particles involved with ionization.

H. Group 1 elements (atomic numbers 3, 11, 19, etc.) only have one electron in the outer orbital.

I. Protons are not added in this process. Electrons are the particles involved with ionization.

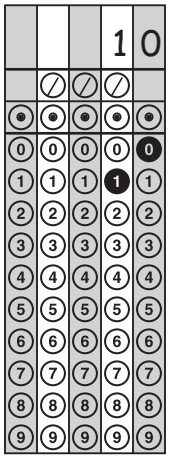
3 **The correct answer is 10 meters.**

Strand: B—Energy

Benchmark: 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). (Also assesses SC.B.1.4.2 understands that there is conservation of mass and energy when matter is transformed.)

Answer Strategy:

An understanding of potential and kinetic energy is required to answer this question. The total energy of the ball is the sum of the potential energy and the kinetic energy. As the ball sits at the height of 20 meters, the gravitational potential energy is the total energy of the ball. The kinetic energy is zero. When the ball is dropped, the potential energy decreases as this energy is transferred into the increasing kinetic energy of motion. As the ball hits the ground, all its energy becomes kinetic energy and the potential energy becomes zero. Therefore, the ball's potential energy equals its kinetic energy at the halfway point. The halfway point in the ball's drop is 20/2 or 10 meters. This is where potential and kinetic energy are the same.



4 **The correct answer is 100 kilograms.**

Strand: C—Force and Motion

Benchmark: 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.

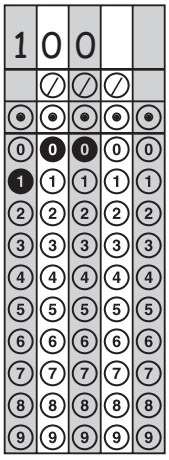
Answer Strategy:

Use the force equation ($F = m \cdot a$) to solve this problem.

F is force in newtons (N), m is mass in kilograms (kg), and a is acceleration in meters per second squared (m/s^2).

In this question, the force applied on Object B is 200 N (from the horizontal scale). The acceleration of Object B is 2 m/s^2 (from the vertical scale). Using these values in the force equation yields:

$$\begin{aligned} 200\ \text{N} &= m \cdot 2\ \text{m/s}^2 \\ 200\ \text{N} / 2\ \text{m/s}^2 &= m \\ 100\ \text{kg} &= m \end{aligned}$$



5 **The correct answer is shown below.**

Strand: D—Processes that Shape the Earth

READ
INQUIRE
EXPLAIN

Benchmark: 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).

Answer Strategy:

An understanding of water's heat capacity is required to answer this question. Since water has the highest heat capacitance, bodies of water heat up and cool down more slowly than landmasses. During the summer, the temperature of coastal waters increases slowly, keeping temperatures cool over the water and nearby land. In winter, coastal waters cool very slowly, keeping the air temperature mild over the water and nearby land.

To receive full credit (2 points) for this question, the response should include a complete explanation of why inland temperatures vary from coastal temperatures. Partially correct answers will receive a score of 1 point.

6 **The correct answer is D (There are no tectonic plate boundaries located near Florida).**

Strand D—Processes that Shape the Earth

Benchmark: 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).

Answer Strategy:

An understanding of why earthquakes occur where they do is required to answer this question. The movement of magma from volcanoes or the release of stress along faults causes earthquakes. These areas are usually found near plate boundaries, areas of volcanic activity, or areas with major fault lines. Florida is not located near any plate boundaries, does not have any areas of volcanic activity, and has no fault lines. Therefore, scientists would not expect major earthquakes to occur in Florida.

Distractor Rationale:

A. The peninsular form of the Floridian landmass does not affect any of the conditions that make earthquake activity likely.

B. Florida does not have areas of volcanic activity nor is it located over a hot spot that forms volcanoes.

C. Earthquakes can occur in areas where limestone rock is present if fault lines or plate boundaries are also present.

7 **The correct answer is F (Earth's rotation).**

Strand E—Earth and Space

Benchmark: 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. (Also assesses SC.E.1.4.2 knows how the characteristics of other planets and satellites are similar to and different from those of the Earth, and SC.E.1.4.3 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.)

Answer Strategy:

Knowledge about Earth's rotation is required to answer this question. When Earth rotates, the Sun is like a stationary object next to a merry-go-round—the object seems to go in the opposite direction of the rider. Earth's rotation, or turning, gives the appearance that the Sun is traveling in the opposite direction of Earth's movement.

Distractor Rationale:

G. Earth's tilt and revolution around the Sun cause changes in the seasons.

H. The spherical shape of Earth does not affect the Sun's rising in the east and setting in the west.

I. Earth's orbit about the Sun does not create the effect of the Sun traveling across the sky from east to west.

8 **The correct answer is C (The location of the Moon is between Earth and the Sun).**

Strand: E—Earth and Space

Benchmark: 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. (Also assesses SC.E.1.4.2 knows how the characteristics of other planets and satellites are similar to and different from those of the Earth, and SC.E.1.4.3 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.)

Answer Strategy:

An understanding of what causes the Moon's "glow" is necessary to answer this question. The Moon's "glow" is caused by the reflection of sunlight off the Moon's surface. The shape of this reflection when viewed from Earth is determined by the Moon's position relative to the Sun and Earth. Because the Moon is, at different times, situated at different angles relative to Earth and the Sun, the light from the Sun causes the Moon's shape to appear to vary from a small crescent to a bright circle. When the Moon is between Earth and the Sun, the Sun's light is reflected off the far side of the Moon away from Earth into space. The Moon appears as a completely darkened circle to an observer on Earth. This darkened circle is the new Moon.

Distractor Rationale:

A. Sunlight is reflected on the backside of the Moon.

B. An observer on Earth's surface cannot see the far side of the Moon.

D. The Moon is always on the same side of the Sun as Earth and cannot be blocked by the Sun. During an eclipse, the Moon momentarily blocks the Sun.

9 **The correct answer is H [The muscles require a greater amount of oxygen (O_2) in order to break down glucose to do work].**

Strand: F—Processes of Life

Benchmark: SC.F.1.4.1 The student knows that the body processes involve specific biochemical reactions governed by biochemical principles. (Also assesses SC.F.1.4.3 knows that membranes are sites for chemical synthesis and essential energy conversions, and SC.F.1.4.5 knows that complex interactions among the different kinds of molecules in the cell cause distinct cycles of activity governed by proteins.)

Answer Strategy:

Knowledge of respiration is required to answer this question. Organisms that respire take in oxygen and glucose and eliminate carbon dioxide and water. In humans, energy is released from glucose obtained from food through the digestive system and oxygen is obtained by breathing. In this experiment, Mike and Maria counted the number of breaths per minute, thereby indirectly measuring the oxygen intake needed for the body to function.

Distractor Rationale:

F. Glucose use or delivery is not measured in this experiment.

G. Oxygen is carried by hemoglobin and used in respiration; however, hemoglobin is not an energy source.

I. Carbon dioxide is not used to break down glucose. Carbon dioxide is a byproduct of the respiration process.

10 **The correct answer is B (mutations within the genetic code).**

Strand F—Processes of Life

Benchmark—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. (Also assesses SC.D.1.4.4 knows that Earth's system and organisms are the result of a long, continuous change over time, and SC.F.1.4.2 knows that body structures are uniquely designed and adapted for their function.)

Answer Strategy:

An understanding of natural selection, genetic variations, and mutations is required to answer this question. During reproduction of a new individual, genetic mutations can occur within the DNA. These mutations can show up as a trait variation within the population. Under most circumstances, these are just variations in characteristics. The organisms with these beneficial characteristics will survive and pass on the genes for these traits.

Distractor Rationale:

A. Environmental changes may cause variations in individuals but they are usually not genetic in nature and are not able to be passed on to a large number of offspring within the population.

C. These responses are usually adaptations and do not result in genetic mutations that are passed on to offspring in the population.

D. Competition will cause certain beneficial traits to be more prevalent within a population, but competition does not cause the genetic changes for those characteristics.

11 **The correct answer is G (The insect population increased).**

Strand: G—How Living Things Interact with Their Environment

Benchmark: SC.G.1.4.1 The student knows of the great diversity and interdependence of living things. (Also assesses SC.G.1.4.2. 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.)

Answer Strategy:

An understanding of the interdependence of species is required to answer this question. Because the brown tree snake had no natural predators on Guam, its population increased. This increased population of brown tree snakes preyed on the eggs of insect-eating birds, decreasing the number of bird eggs and thus decreasing the bird population. As the bird population decreased, there were fewer birds preying on insects. Therefore, the insect population increased.

Distractor Rationale:

F. The bird population would decrease as more of its eggs are eaten.

H. The bird population would not need to seek a new food source since the insect population would increase.

I. The insect population's food source was unaffected and was not a factor.

12 **The correct answer is shown below.**

Strand: G—How Living Things Interact with Their Environment

READ
INQUIRE
EXPLAIN

Benchmark: 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. [Also assesses SC.B.1.4.5 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), and SC.G.2.4.5 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.]

Answer Strategy:

Part A Melaleuca trees have increased in number and limited the biodiversity of the ecosystem. Since some native trees and grasses have been eliminated by the introduction of the Melaleuca trees, the number of organisms that feed on those trees and grasses has been reduced. Any organisms that feed on the Melaleuca trees will increase in number. Nutrients available for other plants will also be reduced, and the water balance in areas will change.

Part B Introducing a new insect into the ecosystem will have unpredictable effects. It might affect other plants in the population in addition to the Melaleuca trees. The insect population may increase in number due to a seemingly endless food supply. Organisms, which eat the non-native insects, may also increase in population. The increased number of these introduced insects might affect the populations of other insects in the ecosystem.

To receive full credit (4 points) for this question, the response should include an explanation of how the ecosystem was altered and the possible consequences of using new insects to control the growth of these trees. Partially correct answers will receive a score of 1, 2, or 3 points.

13 **The correct answer is C (a control group).**

Strand: H—The Nature of Science

Benchmark: 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. [Also assesses SC.H.1.2.1 knows that it is important to keep accurate records and descriptions to provide information and clues on causes of discrepancies in repeated experiments, SC.H.1.2.2 knows that a successful method to explore the natural world is to observe and record, and then analyze and communicate the results, SC.H.2.4.2 knows that scientists control conditions in order to obtain evidence, but when that is not possible for practical or ethical reasons, they try to observe a wide range of natural occurrences to discern patterns, SC.E.2.4.6 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), and SC.E.2.4.7 knows that mathematical models and computer simulations are used in studying evidence from many sources to form a scientific account of the universe.]

Answer Strategy:

Knowledge of the experimental process is required to answer this question. Carmen's hypothesis was that pulse rate is affected by music. Proper experimental design requires a control group, the group of subjects who do not listen to music. The control group should have had their pulses recorded at similar intervals to those exposed to the different types of music. Then the experiment would have been valid because Carmen would have had a group with which to compare her results. This would ensure that the music is the variable affecting pulse rate.

Distractor Rationale:

A. A question is stated in this experiment.

B. A hypothesis, "Pulse rate would change with different types of music" is stated in this experiment.

D. The experiment is well-described and includes the steps to be followed.

14 **The correct answer is H (Increasing the number of coils of an electromagnet increases its strength).**

Strand: H—The Nature of Science

Benchmark: 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.

Answer Strategy:

Interpretation of data in the tables is necessary to answer this question. The numbers in the tables show a direct relationship between the number of coils in an electromagnet and the number of metal screws and straight pins the electromagnet can pick up. The more coils in the electromagnet the more screws and straight pins can be picked up and, thus, the stronger the electromagnet.

Distractor Rationale:

F. The relationship between strength and current was not studied in this experiment.

G. The increase in current was not measured in this experiment.

I. The number of coils on an electromagnet is directly related to the strength of the magnet.

15 **The correct answer is D (An increase in the amount of salt increased the time needed for the samples to freeze).**

Strand H—The Nature of Science

Benchmark: 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.

Answer Strategy:

Interpretation of data in the table is necessary to answer this question. Adding a solute, such as salt, lowers the freezing point of water. If the freezing point of water is lowered, it takes longer for the water to freeze. This is shown in the data table. As the amount of salt increases, the time for water to freeze increases.

Distractor Rationale:

A. Even though the sample did not freeze in this experiment, a general conclusion may be drawn regarding the ability of salt to alter the freezing point of water.

B. The data in the table do not indicate that the doubling of the salt concentration doubles the time for the samples to freeze.

C. The time to freeze increased rather than decreased as the salt amount increased.

16 **The correct answer is G (sonar navigation for submarines).**

Strand: H—The Nature of Science

Benchmark: 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. (Also assesses SC.H.3.4.5 knows that the value of a technology may differ for different people and at different times, and SC.H.3.4.6 knows that scientific knowledge is used by those who engage in design and technology to solve practical problems, taking human values and limitations into account.)

Answer Strategy:

Some knowledge of technology is required to answer this question. Bats emit and receive sound vibrations, and their ears and brain are adapted to determine the location of both prey and objects in areas of limited light similar to the way SONAR operates electronically. SONAR is an acronym for **so**und **na**vigation **r**anging. Submarines contain devices using SONAR to emit sound waves underwater and determine the locations of objects by the object's reflection of these sound signals back to electrical detectors. The time and strength of this reflected signal is calculated to locate the object.

Distractor Rationale:

F. 3-D computer modelling does not use sound waves.

H. Sound waves are different from X-rays.

I. Night-vision goggles use infrared radiation.

Notes

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