2006

FCAT

Florida Comprehensive Assessment Test®

REPORT ON THE 2006 FCAT SCIENCE RELEASED ITEMS

FLORIDA *Inquires!*

GRADES 5, 8 & 11

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Florida Inquires! Report on the 2006 FCAT Science Released Items

Grades 5, 8 & 11

Florida Comprehensive Assessment Test

FCAT

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Preface

Florida Inquires! Report on the 2006 FCAT Science Released Items is provided to help educators understand the scoring of the short-response performance tasks included on the 2006 "Performance Task Student Report" for FCAT Science (Grades 5, 8, and 11). *Florida Reads! Report on the 2006 FCAT Reading Released Items* (Grades 4, 8, and 10) and *Florida Solves! Report on the 2006 FCAT Mathematics Released Items* (Grades 5, 8, and 10) provide information about the reading and mathematics performance tasks featured on the 2006 student reports. *Florida Writes! Report on the 2006 FCAT Writing+ Assessment* (three separate publications for Grades 4, 8, and 10) provides information about the writing assessment administered in 2006. Additional information about FCAT reports can be found in *Understanding FCAT Reports 2006* on the FCAT home page of the Florida Department of Education (DOE) web site at http://www.fldoe.org.

The Performance Task Student Report For FCAT 2006, administered during March 2006, performance task results are provided for students in Grades 5, 8, and 11 on the Science 2006 "Performance Task Student Reports." These reports summarize the total number of points possible on the performance tasks and the number of points each student earned. In addition, each report displays one of the tasks from the test and the number of points the student earned on that task. A copy (image) of the student's actual response to this featured task is printed on the bottom half of the report.

This Booklet General information about the scoring of the FCAT Science performance tasks is provided. Also included are guidelines for scoring the short-response performance tasks that are printed on the 2006 student reports. Each science task in this booklet includes the following:

- the general rubric for each score point;
- the actual task as it appeared in 2006 on the FCAT;
- the scoring guide for that task, which includes an example of a top-score response;
- four sample (anchor) papers for score point two (2);
- four sample (anchor) papers for score point one (1);
- two sample (anchor) papers for score point zero (0); and
- annotations for each sample paper.

Sunshine State Standards

Development of the Sunshine State Standards began in 1993, and the Standards were adopted by the State Board of Education in May 1996 to provide expectations for student achievement in Florida. The Standards were written in seven subject areas, each divided into four separate grade clusters (PreK–2, 3–5, 6–8, and 9–12). This format was chosen to provide flexibility to school districts in designing curricula based on local needs. As Florida moved toward greater accountability for student achievement at each grade level, the Sunshine State Standards were further refined. In the subject areas of language arts, mathematics, science, and social studies, the Sunshine State Standards were expanded to include Grade Level Expectations (GLEs) for PreK–8.

Background Information About FCAT Science

Florida Comprehensive Assessment Test (FCAT) Design

The FCAT was originally designed to measure the reading and mathematics content defined by the Sunshine State Standards. The state writing assessment, first administered in 1992, became part of the FCAT in 1998 and was expanded to include multiple-choice questions in 2006. A test measuring the science Sunshine State Standards was added to the FCAT in 2003. The test questions and prompts are written to measure benchmarks from the Sunshine State Standards that identify what students are expected to know and demonstrate in reading, mathematics, writing, and science.

The FCAT is different from other tests students take in three important ways. First, the FCAT is the only test administered in all Florida public schools that is directly linked to the Sunshine State Standards.

Second, the FCAT is designed to represent the kinds of tasks and activities that parents and teachers expect as part of good instruction. In the FCAT Mathematics, Reading, and Science tests, this is accomplished by presenting on the test the types of information and questions that students encounter in the classroom. In FCAT Writing+, students respond to topics similar to those used in the classroom.

Third, the FCAT demands a more in-depth understanding and application of information than is typical of many standardized tests. The FCAT Mathematics, Reading, and Science tests require students to analyze, synthesize, and evaluate information and to apply strategies or procedures they have learned. Similarly, FCAT Writing+ requires students to demonstrate and apply their writing skills by drafting an original piece of writing in response to a real-world prompt, and respond to multiple-choice questions that assess students' skills with sentence structure, spelling, usage, and grammar.

Science Standards, Benchmarks, and Clusters

The Sunshine State Standards define the content standards for which test items are developed. The Sunshine State Standards identify the knowledge and skills that students are expected to acquire and include an expectation that students become creative and critical thinkers. The importance of thinking skills and problem solving is identified in *Florida's System of School Improvement and Accountability* Standard 4 of Goal 3: "Florida students use creative thinking skills to generate new ideas, make the best decisions, recognize and solve problems through reasoning, interpret symbolic data, and develop efficient techniques for lifelong learning." FCAT test items and performance tasks are developed with the intent of reinforcing the thinking and problem-solving abilities envisioned by this standard.

The term *benchmark* refers to a knowledge and skill statement presented in the Sunshine State Standards. The benchmarks are statements of expected student achievement and are specific to different grade levels. For assessment purposes two or more related benchmarks sometimes are grouped together because the assessment of one benchmark necessarily addresses the other benchmark. More information on the assessment of these benchmarks can be found in *FCAT Science Test Item Specifications*. (See Resources.)

The Sunshine State Standards contain benchmarks in the area of science. For the purpose of reporting FCAT results, science benchmarks are organized into four reporting categories called clusters.

Cluster 1 Physical and Chemical Sciences
Cluster 2 Earth and Space Sciences
Cluster 3 Life and Environmental Sciences
Cluster 4 Scientific Thinking

The specific content strand, standard, and benchmark for each performance task contained in this booklet is followed by an image of the actual science task as it appeared in 2006 on the FCAT.

Test Item Formats

Science test items at Grades 5, 8, and 11 are framed in the context of the Sunshine State Standards. Students are asked to answer questions that connect and apply science concepts, such as the diversity and interdependence of living things.

On FCAT Science tests, students respond to three kinds of questions.

- Multiple-choice questions require students to choose the correct answer from four possible choices.

- Gridded-response questions, at Grades 8 and 11, require students to solve a problem and to bubble their numeric answers in answer grids. Students must solve these problems on their own without being able to guess, as they can with multiple-choice questions. In some cases, the correct answer can be represented in more than one way, such as when one student uses significant figures and another student does not use significant figures to respond to a problem. Similarly, more than one answer can be correct, as can happen when there is a range of acceptable answers.

- Performance tasks require students to think about a scientific concept or problem, develop a strategy, and explain their strategy and solution. There are two kinds of performance tasks: short-response tasks, which require approximately five minutes to answer, and extended-response tasks, which require about ten to fifteen minutes to answer.

To emphasize the thinking required, the performance tasks in science are labeled "Read, Inquire, Explain." For these questions, students are required to respond to a question, and the response is later scored by teams of trained scorers. About 20 percent of the total score points of a test are generated by these performance tasks; the remaining score points come from multiple-choice, and in Grades 8 and 11, gridded-response questions.

Examples of FCAT test items for all grade levels are contained in *Sample Test Books* for FCAT Reading, Writing+, Mathematics, and Science tests. Sample Test Materials and released FCAT Reading and FCAT Mathematics test items and answer keys are distributed to school districts prior to the FCAT administration each year and can be downloaded from the FCAT home page on the DOE web site at http://www.fldoe.org. (See Resources.)

How FCAT Science Is Scored

The FCAT is scored both manually and electronically. All of the answer documents that students complete are scanned using a process called *imaging,* which involves capturing electronic images of the pages that include students' answers in their own handwriting. Students' multiple-choice and gridded responses are machine-scored using computer programs that read the students' bubbled answers and evaluate them based on an answer key. Students' answers to the performance tasks, however, must be scored by trained scorers using a process commonly called *handscoring*.

The handscoring of students' written responses is conducted by professional scorers. These scorers are required to have college degrees and are specially trained to score student papers. Scorers may only use the FCAT scoring rubrics and item-specific scoring criteria that have been established and validated by teams of Florida educators at FCAT Rangefinding meetings. (The General Scoring Rubrics can be found in Appendix A.)

After each science performance task is administered in a field test to a sample of Florida students, a team of Florida science teachers and administrators works with Florida Department of Education staff to score a sample of these papers. A top-score response for each task is defined, and papers representing the possible scores for that task are identified: 4, 3, 2, 1, and 0 for extended-response tasks; and 2, 1, and 0 for short-response tasks. In this way, clear definitions of each score point are developed, and model papers, called *anchor papers*, are selected to represent the range of responses for each possible score point.

These field-test papers, scored by the team of Florida educators, then become the training materials for the professional scorers. This process and the quality control measures (reliability and validity checks) implemented during scoring ensure that all performance tasks are scored according to Florida's standards. Each student response is read independently by at least two professional scorers. For short-response performance tasks, if the scorers' two scores are not identical, a third scorer reviews the scoring to resolve the difference. For extended-response performance tasks, a third scorer is used if the first two scores are nonadjacent, that is, if they differ by more than one point. This third scoring, called *resolution scoring*, is performed by a scoring supervisor. All scoring is monitored by Florida Department of Education staff.

Scores from the handscoring process are combined with scores from the machine-scoring process to create a record for each student. The student's total scale score is created by a computer-based analysis procedure that combines the scores from the various types of test items. Scale scores are used to report student results because of their precision and because they can be equated from year to year. Equating scores ensures the same standard of achievement is used each year. In this way, scores can be compared from year to year, and the progress of students and schools can be evaluated fairly.

For more detailed information about scoring performance tasks, see *FCAT Performance Task Scoring—Practice for Educators* publications and software sent to Florida school districts in 2001. Also, more information can be found in the *FCAT Handbook—A Resource for Educators,* which can be downloaded from the DOE web site.

Holistic Scoring

What is holistic scoring? Student responses to the FCAT Science performance tasks are scored holistically. The term *holistic* is used to emphasize the importance of the whole work, including the interdependence of its parts. A rubric is used to evaluate student responses to each task. Different rubrics are used for the two different types of tasks, short- and extended-response. Holistic scoring is a method of evaluation that is used in many state assessments and involves judging a student response for its *total* effect. No single factor is weighted to the exclusion of any other.

Analytic scoring, on the other hand, is a method of scoring in which separate judgments or ratings are made for each of several traits. In science, for example, the scorer might evaluate such traits as parts of process, method, and scientific accuracy, giving a separate score for each. It is important to note that separate analytic judgments are **not** made when scoring the FCAT performance tasks. By scoring holistically, scorers take all traits into consideration and give a single, overall score. Potential bias issues are also discussed with scorers. (See Appendix C.)

What is a rubric? A rubric is a general guide for scoring. It identifies the performance features to be evaluated and describes how performance varies across the scoring scale. For the FCAT Science extended-response tasks, a 4-point rubric is used (4, 3, 2, 1, 0). A 2-point rubric (2, 1, 0) is used for short-response tasks. (Appendix A includes the 2-point and 4-point rubrics used for scoring the FCAT Science performance tasks.) The 2-point rubric precedes each short-response performance task within this booklet as well.

What are anchor papers? Anchor papers are actual, unedited student responses demonstrating typical performance for each point in the rubric. They are used to train professional scorers to recognize, for example, what a score point 4 response looks like or what a score point 2 response looks like. Anchor papers also help scorers make decisions about assigning score points during live scoring.

What are annotations? Annotations explain the reasoning associated with a particular score. They describe the strengths and weaknesses of a paper. Annotations are used to train scorers by giving them insights into the knowledge and reasoning skills that students use in responding to performance tasks.

Scoring Tools for FCAT Science

Two scoring tools are available for scorers of the FCAT Science performance tasks.

- **General Rubrics** General scoring rubrics are available for both the short-response tasks and the extended-response tasks. (See Appendix A.) These rubrics describe the characteristics associated with each score point. Because they are general, these rubrics apply to all science performance tasks.

- **Example of a Top-Score Response** The top-score response displays one example of a correct and complete response *for that particular task*.

When used in combination with the anchor responses and annotations, these scoring tools give scorers and teachers a clear and comprehensive understanding of how to interpret and evaluate students' responses to the FCAT Science performance tasks.

Grade 5

Short-Response Performance Task

- Calculators are not required for Grade 5 FCAT Science.
- Any formulas that students need for answering Grade 5 FCAT Science items are provided.

General Short-Response Scoring Rubric

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Score	Description
2	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 the demonstration of a thorough understanding.
1	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	A score of zero indicates that the student has not provided a response or has provided a response that does not demonstrate an understanding of the scientific concepts and/or procedures embodied in the task. The student's explanation may be uninterpretable, lack sufficient information to determine the student's understanding, contain clear misunderstandings of the underlying scientific concepts and/or procedures, or may be incorrect.

Science Short-Response Performance Task from FCAT 2006

The strand, standard, and benchmark for the task are presented below along with the task as it appears in the FCAT 2006 test.

Description of Task

Strand H: The Nature of Science

Standard 1: The student uses the scientific processes and habits of mind to solve problems.

Benchmark: SC.H.1.2.2 The student knows that a successful method to explore the natural world is to observe and record, and then analyze and communicate the results. (Also assesses SC.H.1.2.4 Knows that to compare and contrast observations and results is an essential skill in science and SC.H.3.2.2 Knows that data are collected and interpreted in order to explain an event or concept.)

Performance Task: Fifth grade students were directed to respond in their test books. The performance task below was reduced to fit on this page. The actual size is shown on the following page.

READ
INQUIRE
EXPLAIN

Sam and Erin are studying photosynthesis, the process by which plants make food. They know the process of photosynthesis produces oxygen (O_2) gas. They set up an experiment in which they place water plants in each of five test tubes containing water like the one shown in Figure 1. Next, Sam and Erin place the test tubes at different distances from a light source. They observe that the plants produce bubbles of gas. They count the number of bubbles produced per minute in each test tube. Their results are shown in the table below.

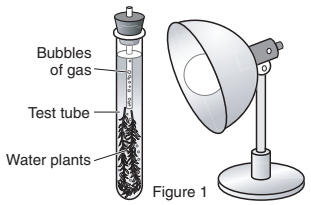

Figure 1

Test Tube Number	Distance from Light (in centimeters)	Bubbles (per minute)
1	10	45
2	30	30
3	50	19
4	70	6
5	100	1

Part A Explain how the distance from the light source affects the production of bubbles.

Part B Identify one thing Sam and Erin could do to improve their experiment. Explain why this change should be made.

Example of a Top-Score Response for This Task

READ
INQUIRE
EXPLAIN

Sam and Erin are studying photosynthesis, the process by which plants make food. They know the process of photosynthesis produces oxygen (O_2) gas. They set up an experiment in which they place water plants in each of five test tubes containing water like the one shown in Figure 1. Next, Sam and Erin place the test tubes at different distances from a light source. They observe that the plants produce bubbles of gas. They count the number of bubbles produced per minute in each test tube. Their results are shown in the table below.

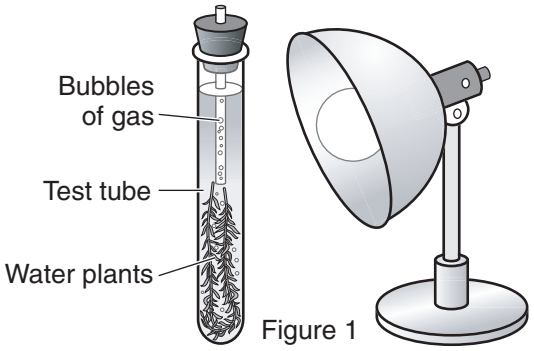

Figure 1

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1	10	45
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4	70	6
5	100	1

Part A Explain how the distance from the light source affects the production of bubbles.

An explanation similar to the following:

The closer the plant is to the light, the more bubbles are produced. When the plant is farther from the light, fewer bubbles are produced.

Part B Identify one thing Sam and Erin could do to improve their experiment. Explain why this change should be made.

An explanation similar to the following:

They could repeat their experiment more times to make sure their results are valid.

READ
INQUIRE
EXPLAIN

Sam and Erin are studying photosynthesis, the process by which plants make food. They know the process of photosynthesis produces oxygen (O_2) gas. They set up an experiment in which they place water plants in each of five test tubes containing water like the one shown in Figure 1. Next, Sam and Erin place the test tubes at different distances from a light source. They observe that the plants produce bubbles of gas. They count the number of bubbles produced per minute in each test tube. Their results are shown in the table below.

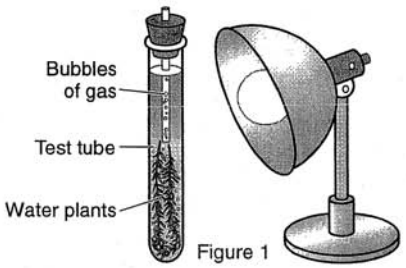

Figure 1

Test Tube Number	Distance from Light (in centimeters)	Bubbles (per minute)
1	10	45
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5	100	1

Part A Explain how the distance from the light source affects the production of bubbles.

When they light is close more bubbles are produced, when the Light is far away less bubbles are produced.

Part B Identify one thing Sam and Erin could do to improve their experiment. Explain why this change should be made.

They could do the experiment again. To see if they get the same results the second time.

SCORE POINT
2

The response demonstrates a thorough understanding of how to interpret table data and methods to improve an experiment. The statement "When they light is close more bubbles are produced, when the light is far away less bubbles are produced," clearly explains the relationship between the distance from the light source and bubble production. The statement "They could do the experiment again. To see if they get the same results the second time," is a scientifically sound method that Sam and Erin could use to improve their experiment. Repetition of their experiment and comparison of results would increase the validity of their results. The response is clear and complete.

READ
INQUIRE
EXPLAIN

Sam and Erin are studying photosynthesis, the process by which plants make food. They know the process of photosynthesis produces oxygen (O_2) gas. They set up an experiment in which they place water plants in each of five test tubes containing water like the one shown in Figure 1. Next, Sam and Erin place the test tubes at different distances from a light source. They observe that the plants produce bubbles of gas. They count the number of bubbles produced per minute in each test tube. Their results are shown in the table below.

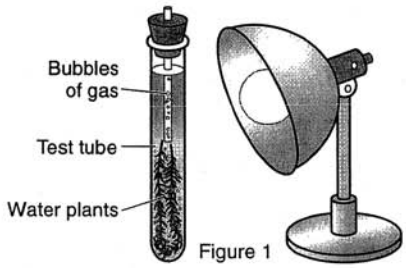

Figure 1

Test Tube Number	Distance from Light (in centimeters)	Bubbles (per minute)
1	10	45
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4	70	6
5	100	1

Part A Explain how the distance from the light source affects the production of bubbles.

IF the light is to Far away From the test tube the bubbles won't Form.

Part B Identify one thing Sam and Erin could do to improve their experiment. Explain why this change should be made.

One thing they could change is they should have tested the experiment 5 or more times. This change should have been made so they get more accurate results.

SCORE POINT
2

The response demonstrates a thorough understanding of how to interpret table data and methods to improve an experiment. The statement "If the light is to Far away from the test tube the bubbles won't form," is a reasonable explanation of how the distance from the light source affects bubble production. The statement "they should have tested the experiment 5 or more times. This change should have been made so they get more accurate results," is an acceptable method that Sam and Erin could use to improve their experiment. Repetition of their experiment would increase the validity of their results. The response is clear and complete.

READ
INQUIRE
EXPLAIN

Sam and Erin are studying photosynthesis, the process by which plants make food. They know the process of photosynthesis produces oxygen (O_2) gas. They set up an experiment in which they place water plants in each of five test tubes containing water like the one shown in Figure 1. Next, Sam and Erin place the test tubes at different distances from a light source. They observe that the plants produce bubbles of gas. They count the number of bubbles produced per minute in each test tube. Their results are shown in the table below.

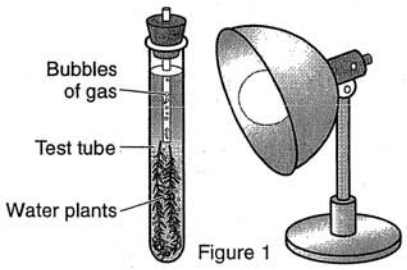

Figure 1

Test Tube Number	Distance from Light (in centimeters)	Bubbles (per minute)
1	10	45
2	30	30
3	50	19
4	70	6
5	100	1

Part A Explain how the distance from the light source affects the production of bubbles.

When the tube is placed farther away, it produces less bubbles.

Part B Identify one thing Sam and Erin could do to improve their experiment. Explain why this change should be made.

They should measure the length of each plant because if one plant is bigger it could produce more oxygen.

SCORE POINT
2

The response demonstrates a thorough understanding of how to interpret table data and methods to improve an experiment. The statement "When the tube is placed farther away, it produces less bubbles," correctly explains the relationship between the distance from the light source and bubble production. The statement "They should measure the length of each plant because if one plant is bigger it could produce more oxygen," is an acceptable method that Sam and Erin could use to improve their experiment. Controlling variables is an improvement to the experimental design that would increase the validity of their results. The response is clear and complete.

READ
INQUIRE
EXPLAIN

Sam and Erin are studying photosynthesis, the process by which plants make food. They know the process of photosynthesis produces oxygen (O_2) gas. They set up an experiment in which they place water plants in each of five test tubes containing water like the one shown in Figure 1. Next, Sam and Erin place the test tubes at different distances from a light source. They observe that the plants produce bubbles of gas. They count the number of bubbles produced per minute in each test tube. Their results are shown in the table below.

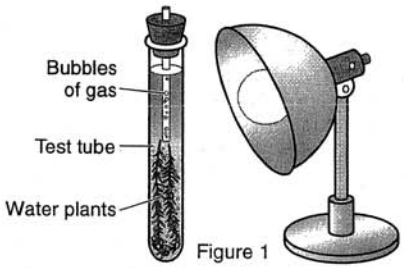

Figure 1

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1	10	45
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4	70	6
5	100	1

Part A Explain how the distance from the light source affects the production of bubbles.

The farther away from the light, less bubbles produced per minute.

Part B Identify one thing Sam and Erin could do to improve their experiment. Explain why this change should be made.

They could put two test tubes the same distance from the light to see if it would end up the same.

SCORE POINT
2

The response demonstrates a thorough understanding of how to interpret table data and methods to improve an experiment. The statement "The farther away from the light, less bubbles produced per minute," correctly explains the relationship between the distance from the light source and bubble production. The statement "They could put two test tubes the same distance from the light to see if it would end up the same," is an acceptable method that Sam and Erin could use to improve their experiment. Conducting more trials would increase the validity of their results. The response is clear and complete.

READ
INQUIRE
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Sam and Erin are studying photosynthesis, the process by which plants make food. They know the process of photosynthesis produces oxygen (O_2) gas. They set up an experiment in which they place water plants in each of five test tubes containing water like the one shown in Figure 1. Next, Sam and Erin place the test tubes at different distances from a light source. They observe that the plants produce bubbles of gas. They count the number of bubbles produced per minute in each test tube. Their results are shown in the table below.

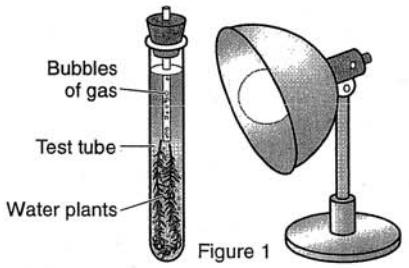

Figure 1

Test Tube Number	Distance from Light (in centimeters)	Bubbles (per minute)
1	10	45
2	30	30
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5	100	1

Part A Explain how the distance from the light source affects the production of bubbles.

The closer the light is a greater precentage of the light hits the plants. The farther away the plant is from the light the less light gets to the plants.

Part B Identify one thing Sam and Erin could do to improve their experiment. Explain why this change should be made.

Sam and Erin should do the expirement three times. Doing this would show that the results are valid.

SCORE POINT
1

The response demonstrates partial understanding of how to interpret table data and methods to improve an experiment. The statement "The closer the light is a greater precentage of the light hits the plants. The farther away the plant is from the light the less light gets to the plants," explains the amount of light as a function of distance from the light source but does not address the production of bubbles, which detracts from the demonstration of a thorough understanding. The statement "Sam and Erin should do the expirement three times. Doing this would show that the results are valid," is a scientifically sound method that Sam and Erin could use to improve their experiment. Repetition of their experiment would increase the validity of their results.

READ
INQUIRE
EXPLAIN

Sam and Erin are studying photosynthesis, the process by which plants make food. They know the process of photosynthesis produces oxygen (O_2) gas. They set up an experiment in which they place water plants in each of five test tubes containing water like the one shown in Figure 1. Next, Sam and Erin place the test tubes at different distances from a light source. They observe that the plants produce bubbles of gas. They count the number of bubbles produced per minute in each test tube. Their results are shown in the table below.

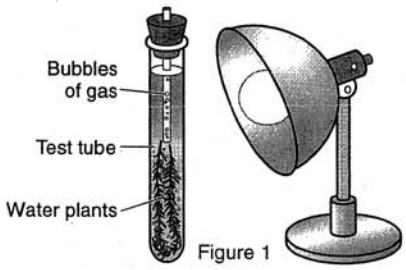

Figure 1

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1	10	45
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4	70	6
5	100	1

Part A Explain how the distance from the light source affects the production of bubbles.

The farther it is then you will get less bubbles then if you get the light closer to the test tube.

Part B Identify one thing Sam and Erin could do to improve their experiment. Explain why this change should be made.

They could use a different plant and see if that would change any thing, and see how many bubbles will be made with a different plant.

SCORE POINT
1

The response demonstrates partial understanding of how to interpret table data and methods to improve an experiment. The statement "The farther it is then you will get less bubbles . . . ," correctly explains the relationship between the distance from the light source and bubble production. The statement "They could use a different plant and see if that would change any thing," does not identify a method that Sam and Erin could use to improve their experiment. Using a different plant adds an independent variable and changes the experiment.

READ
INQUIRE
EXPLAIN

Sam and Erin are studying photosynthesis, the process by which plants make food. They know the process of photosynthesis produces oxygen (O_2) gas. They set up an experiment in which they place water plants in each of five test tubes containing water like the one shown in Figure 1. Next, Sam and Erin place the test tubes at different distances from a light source. They observe that the plants produce bubbles of gas. They count the number of bubbles produced per minute in each test tube. Their results are shown in the table below.

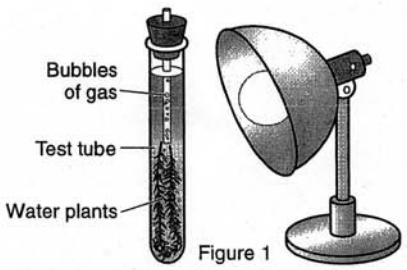

Figure 1

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1	10	45
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4	70	6
5	100	1

Part A Explain how the distance from the light source affects the production of bubbles.

The distance from the sunlight effects it because the bubble would change but the bubbles would still have the same minute they did before

Part B Identify one thing Sam and Erin could do to improve their experiment. Explain why this change should be made.

Sam and Erin should use more data and they should do a hypothesis to improve their experiment.

SCORE POINT
1

The response demonstrates partial understanding of how to interpret table data and methods to improve an experiment. The statement "The distance from the sunlight effects it because the bubble would change but the bubbles would still have the same minute they did before," is uninterpretable and does not explain the relationship between the distance from the light source and bubble production. The statement "use more data" is a scientifically sound method that Sam and Erin could use to improve their experiment. Collecting more data would increase the validity of their results. The statement "do a hypothosis to improve their experiment" is unclear.

READ
INQUIRE
EXPLAIN

Sam and Erin are studying photosynthesis, the process by which plants make food. They know the process of photosynthesis produces oxygen (O_2) gas. They set up an experiment in which they place water plants in each of five test tubes containing water like the one shown in Figure 1. Next, Sam and Erin place the test tubes at different distances from a light source. They observe that the plants produce bubbles of gas. They count the number of bubbles produced per minute in each test tube. Their results are shown in the table below.

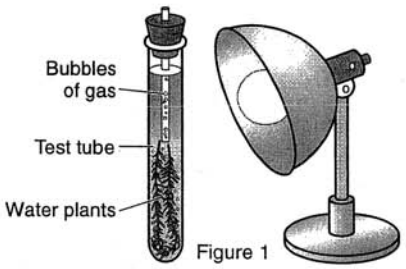


Figure 1

Test Tube Number	Distance from Light (in centimeters)	Bubbles (per minute)
1	10	45
2	30	30
3	50	19
4	70	6
5	100	1

Part A Explain how the distance from the light source affects the production of bubbles.

In the plants photosynthesis Light is What produces the oxygen (O2)

Part B Identify one thing Sam and Erin could do to improve their experiment. Explain why this change should be made.

Sam and Erin Should make Sure it is the Same aquatic plant because one could go through photosynthesis faster.

SCORE POINT
1

The response demonstrates partial understanding of how to interpret table data and methods to improve an experiment. The statement "In the plants photosynthesis Light is What produces the oxygen (O^2)," does not explain the relationship between the distance from the light source and bubble production. The statement "Sam and Erin should make sure it is the same aquatic plant because one could go through photosynthesis faster," is a scientifically sound method that Sam and Erin could use to improve their experiment. Controlling variables is an improvement to the experimental design that would increase the validity of their results.

READ
INQUIRE
EXPLAIN

Sam and Erin are studying photosynthesis, the process by which plants make food. They know the process of photosynthesis produces oxygen (O_2) gas. They set up an experiment in which they place water plants in each of five test tubes containing water like the one shown in Figure 1. Next, Sam and Erin place the test tubes at different distances from a light source. They observe that the plants produce bubbles of gas. They count the number of bubbles produced per minute in each test tube. Their results are shown in the table below.

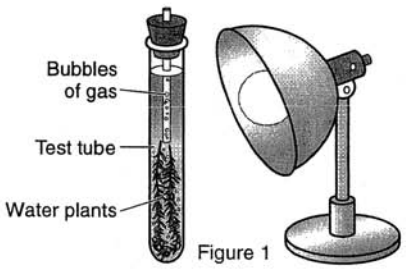


Figure 1

Test Tube Number	Distance from Light (in centimeters)	Bubbles (per minute)
1	10	45
2	30	30
3	50	19
4	70	6
5	100	1

Part A Explain how the distance from the light source affects the production of bubbles.

The light is causing the water in the test tube to boil because of the heat it is giving it.

Part B Identify one thing Sam and Erin could do to improve their experiment. Explain why this change should be made.

Sam and Erin could have used a different object to experiment these things used in the container shown in the picture.

SCORE POINT
0

The response demonstrates a lack of understanding of how to interpret table data and methods to improve an experiment. The statement "The Light is causing the water in the test tube to boil because of the heat it is giving it," does not address how the distance from the light source affects the production of bubbles, but instead incorrectly attributes the formation of bubbles to the heat. The statement "Sam and Erin could have used a different object to experiment these things used in the container shown in the picture," does not identify a method that Sam and Erin could use to improve their experiment. Using a different object adds an independent variable and changes the parameters of the experiment. The response does not demonstrate an understanding of the scientific concepts embodied in the task.

READ
INQUIRE
EXPLAIN

Sam and Erin are studying photosynthesis, the process by which plants make food. They know the process of photosynthesis produces oxygen (O_2) gas. They set up an experiment in which they place water plants in each of five test tubes containing water like the one shown in Figure 1. Next, Sam and Erin place the test tubes at different distances from a light source. They observe that the plants produce bubbles of gas. They count the number of bubbles produced per minute in each test tube. Their results are shown in the table below.

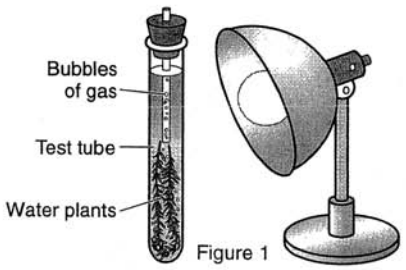


Figure 1

Test Tube Number	Distance from Light (in centimeters)	Bubbles (per minute)
1	10	45
2	30	30
3	50	19
4	70	6
5	100	1

Part A Explain how the distance from the light source affects the production of bubbles.

The light source effects the production of bubbles by how far away it is from the plants.

Part B Identify one thing Sam and Erin could do to improve their experiment. Explain why this change should be made.

The one thing they can improve is they can work on different kinds of plants instead of that kind only.

SCORE POINT
0

The response demonstrates a lack of understanding of how to interpret table data and methods to improve an experiment. The statement "The light source effects the production of bubbles by how far away it is from the plants," is a restatement of information provided in the prompt and does not explain the relationship between the distance from the light source and bubble production. The statement "they can work on different kinds of plants instead of that kind only," does not identify a method that Sam and Erin could use to improve their experiment. Using different kinds of plants adds an independent variable and changes the parameters of the experiment. The response does not demonstrate an understanding of the scientific concepts embodied in the task.

Grade 8

Short-Response Performance Task

- Calculators are provided for Grade 8 students to use for FCAT Science.
- FCAT Science Reference Sheets with formulas and conversions and the Periodic Table of the Elements are provided for Grade 8 students. (See Appendix B.)

READ
INQUIRE
EXPLAIN

General Short-Response Scoring Rubric

Score	Description
2	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 the demonstration of a thorough understanding.
1	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	A score of zero indicates that the student has not provided a response or has provided a response that does not demonstrate an understanding of the scientific concepts and/or procedures embodied in the task. The student's explanation may be uninterpretable, lack sufficient information to determine the student's understanding, contain clear misunderstandings of the underlying scientific concepts and/or procedures, or may be incorrect.

Science Short-Response Performance Task from FCAT 2006

The strand, standard, and benchmark for the task are presented below along with the task as it appears in the FCAT 2006 test.

Description of Task

Strand F: Processes of Life

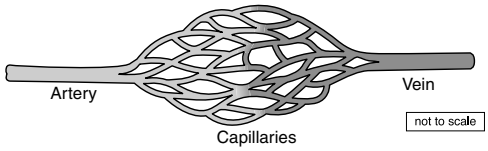
Standard 1: The student describes patterns of structure and function in living things.

Benchmark: SC.F.1.3.1 The student understands that living things are composed of major systems that function in reproduction, growth, maintenance, and regulation.

Performance Task: Eighth grade students were directed to their answer books to respond to this question. The performance task below was reduced to fit on this page. The actual size is shown on the following page, though in the test book, the item appeared on two facing pages.

READ
INQUIRE
EXPLAIN

The human circulatory system includes three types of blood vessels: arteries, capillaries, and veins. Fatty material can collect inside the arteries and over time the arterial walls will thicken with fatty deposits. An artery, capillaries, and a vein are shown below.



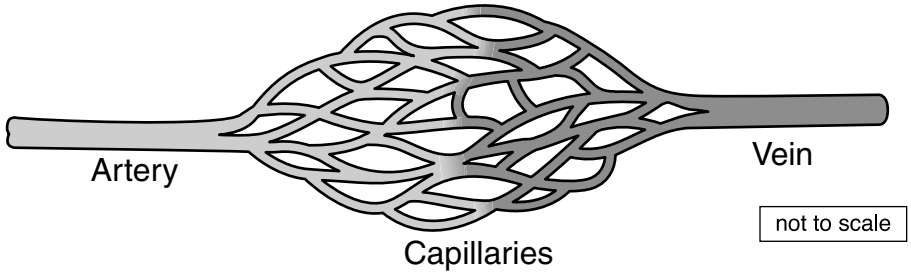
Part A Explain what might happen to blood flow in the circulatory system if several arterial walls thicken this way.

Part B What effect will this thickening of arterial walls have on the heart?

Example of a Top-Score Response for This Task

READ
INQUIRE
EXPLAIN

The human circulatory system includes three types of blood vessels: arteries, capillaries, and veins. Fatty material can collect inside the arteries and over time the arterial walls will thicken with fatty deposits. An artery, capillaries, and a vein are shown below.



Part A Explain what might happen to blood flow in the circulatory system if several arterial walls thicken this way.

An explanation similar to the following:

Arterial wall thickening will cause the blood flow through the circulatory system to slow down.

Part B What effect will this thickening of arterial walls have on the heart?

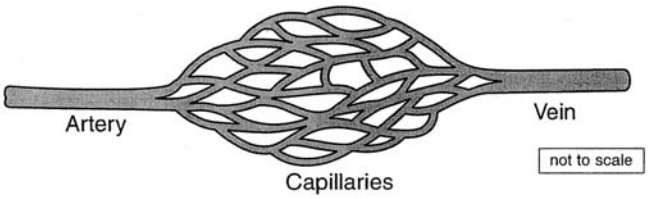
An explanation similar to the following:

This thickening may cause a heart attack because the heart has to work much harder to move the blood through the blood vessels.

STUDENT RESPONSE

READ
INQUIRE
EXPLAIN

The human circulatory system includes three types of blood vessels: arteries, capillaries, and veins. Fatty material can collect inside the arteries and over time the arterial walls will thicken with fatty deposits. An artery, capillaries, and a vein are shown below.



Part A Explain what might happen to blood flow in the circulatory system if several arterial walls thicken this way.

If the arterial walls thicken with fatty deposits, the blood flow will slow down. This is because the arterial walls are too thick for the blood to quickly flow through the arteries, into the capillaries, and through the veins.

Part B What effect will this thickening of arterial walls have on the heart?

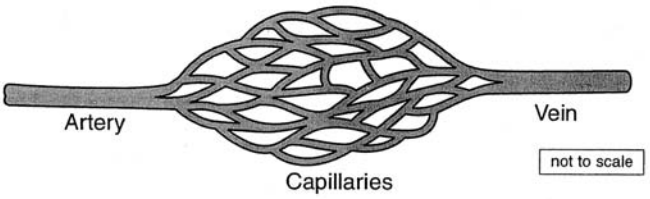
The heart will have to work a lot harder so that the blood can flow through your body, which can cause various heart conditions and even heart attacks.

SCORE POINT
2

The response demonstrates a thorough understanding of the effects that arterial wall thickening can have on blood flow in the circulatory system and on the heart. The statement "the blood flow will slow down . . . because the arterial walls are too thick for the blood to quickly flow . . . ," clearly explains the reduction in blood flow that can result from arterial wall thickening. The statement "The heart will have to work a lot harder so that blood can flow through your body . . . ," is a scientifically sound explanation of how arterial wall thickening can affect blood flow. The heart does work harder to pump blood through thickened arterial walls. The statement, "which can cause various heart conditions and even heart attacks," demonstrates understanding of an effect that arterial wall thickening can have on the heart. The response is clear and complete.

READ
INQUIRE
EXPLAIN

The human circulatory system includes three types of blood vessels: arteries, capillaries, and veins. Fatty material can collect inside the arteries and over time the arterial walls will thicken with fatty deposits. An artery, capillaries, and a vein are shown below.



Part A Explain what might happen to blood flow in the circulatory system if several arterial walls thicken this way.

The blood flow wouldn't be able to go through the arteries as easily causing stress. This also means that the blood couldn't go through as fast causing a heart attack or a stroke.

Part B What effect will this thickening of arterial walls have on the heart?

The thickening of the walls may lead to the heart not getting enough blood. Since the blood carries oxygen to the heart, the heart might not have enough oxygen and that could cause a heart attack.

STUDENT RESPONSE

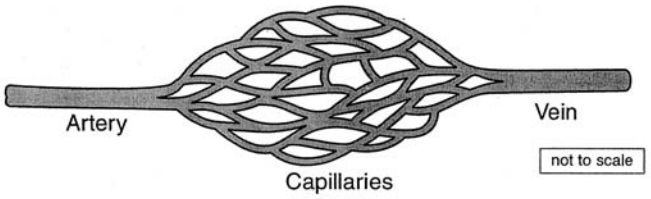
SCORE POINT
2

The response demonstrates a thorough understanding of the effects that arterial wall thickening can have on blood flow in the circulatory system and on the heart. The statement "the blood couldn't go through as fast . . . ," clearly explains the reduction in blood flow to the heart that can result from arterial wall thickening. The statements "causing a heart attack," and "might not have enough oxygen and that could cause a heart attack" clearly addresses the effect on the heart, because reduction in blood flow to the heart can cause heart attacks. The statement "or stroke" is a minor flaw. A stroke is an effect on the brain rather than the heart. The response is clear and complete.

STUDENT RESPONSE

READ
INQUIRE
EXPLAIN

The human circulatory system includes three types of blood vessels: arteries, capillaries, and veins. Fatty material can collect inside the arteries and over time the arterial walls will thicken with fatty deposits. An artery, capillaries, and a vein are shown below.



Part A Explain what might happen to blood flow in the circulatory system if several arterial walls thicken this way.

If several artery walls are thickened with fatty deposits, the blood flow in the circulatory system will be decreased. Less blood will be able to get through the artery, therefore not enough blood will get to the cells of the person.

Part B What effect will this thickening of arterial walls have on the heart?

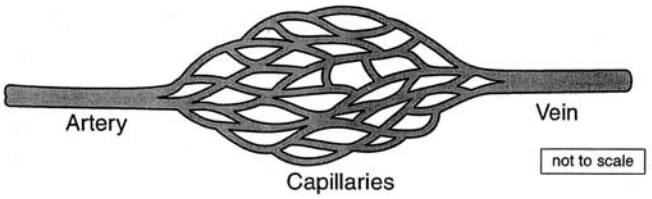
This thickening of arterial walls will have an effect on the heart. It will have to pump harder to force the blood through the smaller space that the artery has and this might lead to a heart attack because of the strain.

SCORE POINT
2

The response demonstrates a thorough understanding of the effects that arterial wall thickening can have on blood flow in the circulatory system and on the heart. The statement "Less blood will be able to get through the artery . . . ," correctly explains the reduction in blood flow that can result from arterial wall thickening. *Part B* correctly connects the reduction in blood flow to the heart. The statement "the heart . . . will have to pump harder to force the blood through the smaller space," is a scientifically sound explanation that connects the reduction in blood flow to an effect on the heart. The statement "this might lead to a heart attack because of the strain," demonstrates understanding of an effect that arterial wall thickening can have on the heart. The response is clear and complete.

READ
INQUIRE
EXPLAIN

The human circulatory system includes three types of blood vessels: arteries, capillaries, and veins. Fatty material can collect inside the arteries and over time the arterial walls will thicken with fatty deposits. An artery, capillaries, and a vein are shown below.



Part A Explain what might happen to blood flow in the circulatory system if several arterial walls thicken this way.

it would clog causeing restriction of blood flow eventuly resulting in a heart it attack!

Part B What effect will this thickening of arterial walls have on the heart?

it will cause the heart to work harder then it all ready is, putting to much stain on it eventuly causeing a heart it attack.

STUDENT RESPONSE

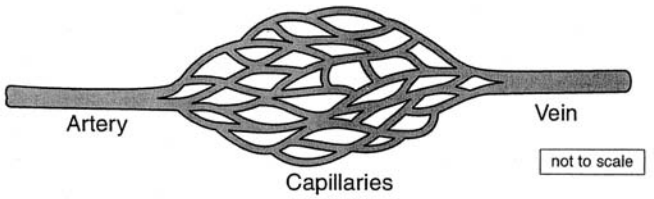
SCORE POINT
2

The response demonstrates a thorough understanding of the effects that arterial wall thickening can have on blood flow in the circulatory system and on the heart. The statement "it would clog causeing restriction of blood flow . . . ," correctly explains the reduction in blood flow that can result from arterial wall thickening. The statement "resulting in a heart it attack!" demonstrates understanding of an effect that arterial wall thickening can have on the heart. The statement "it will cause the heart to work harder . . . ," clearly explains the connection between reduced blood flow and an effect on the heart. *Part B* restates information provided in *Part A*: "eventuly causeing a heart it attack," which is correct. The response is clear and complete.

STUDENT RESPONSE

READ
INQUIRE
EXPLAIN

The human circulatory system includes three types of blood vessels: arteries, capillaries, and veins. Fatty material can collect inside the arteries and over time the arterial walls will thicken with fatty deposits. An artery, capillaries, and a vein are shown below.



Part A Explain what might happen to blood flow in the circulatory system if several arterial walls thicken this way.

Something that might happen if arterial walls thicken this way would be a blood clot that stops the blood's flow.

Part B What effect will this thickening of arterial walls have on the heart?

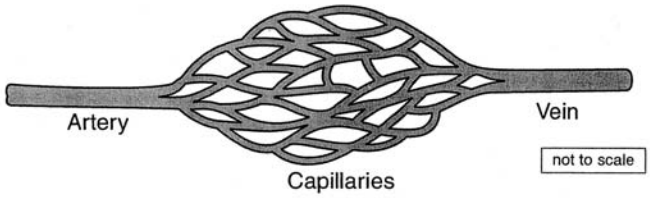
It will force the heart probably to beat faster to try & get more blood past the clot.

SCORE POINT
1

The response demonstrates partial understanding of the effects that arterial wall thickening can have on blood flow in the circulatory system and on the heart. The statement "a blood clot that stops the blood's flow," correctly explains the reduction in blood flow that can result from arterial wall thickening, since blood clots can stop blood flow. *Part B* incorrectly addresses the effect on the heart. The statement "force the heart probably to beat faster to try & get more blood past the clot," demonstrates some misunderstanding of the effects that arterial wall thickening can have on the heart. Blood clots do not cause the heart to beat faster, because heart rate is not regulated by blood flow. The heart will beat harder, rather than faster, in response to arterial wall thickening.

READ
INQUIRE
EXPLAIN

The human circulatory system includes three types of blood vessels: arteries, capillaries, and veins. Fatty material can collect inside the arteries and over time the arterial walls will thicken with fatty deposits. An artery, capillaries, and a vein are shown below.



Part A Explain what might happen to blood flow in the circulatory system if several arterial walls thicken this way.

The blood flow in the circulatory system will eventually be slowed down if several of the arterial walls thicken with fatty deposits.

Part B What effect will this thickening of arterial walls have on the heart?

The effect of the arterial walls thickening will cause stress on the heart. The heart would have to work more rapidly inorder for the blood supply to keep moving.

STUDENT RESPONSE

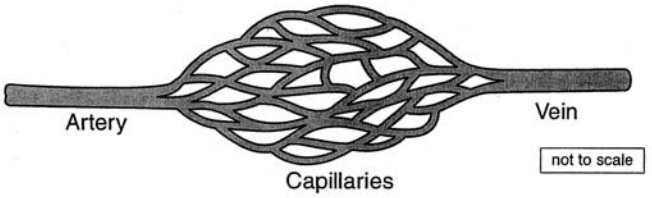
SCORE POINT
1

The response demonstrates partial understanding of the effects that arterial wall thickening can have on blood flow in the circulatory system and on the heart. The statement "The blood flow in the circulatory system will eventually be slowed down . . . ," correctly explains the reduction in blood flow that can result from arterial wall thickening. The statement "will cause stress on the heart," does not clearly explain an effect on the heart. The statement, "The heart would have to work more rapidly inorder for the blood supply to keep moving," demonstrates some misunderstanding of the effects that arterial wall thickening can have on the heart. Arterial wall thickening does not cause the heart to beat faster, because heart rate is not regulated by blood flow. The heart will beat harder, rather than faster, in response to arterial wall thickening.

STUDENT RESPONSE

READ
INQUIRE
EXPLAIN

The human circulatory system includes three types of blood vessels: arteries, capillaries, and veins. Fatty material can collect inside the arteries and over time the arterial walls will thicken with fatty deposits. An artery, capillaries, and a vein are shown below.



Part A Explain what might happen to blood flow in the circulatory system if several arterial walls thicken this way.

The heart will have to work harder because the blood is having a hard time getting through the artery, capillaries, and veins.

Part B What effect will this thickening of arterial walls have on the heart?

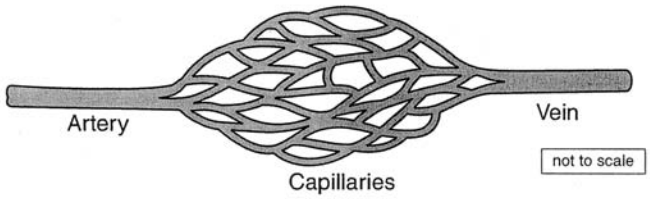
The heart will have to work harder.

SCORE POINT 1

The response demonstrates partial understanding of the effects that arterial wall thickening can have on blood flow in the circulatory system and on the heart. The statement "blood is having a hard time getting through . . . ," addresses the reduction of blood flow that can result from arterial wall thickening, and is further explained by the statement "The heart will have to work harder." The heart does work harder to pump the blood through thickened arterial walls; however, this statement does not explain the effect on the heart itself.

READ
INQUIRE
EXPLAIN

The human circulatory system includes three types of blood vessels: arteries, capillaries, and veins. Fatty material can collect inside the arteries and over time the arterial walls will thicken with fatty deposits. An artery, capillaries, and a vein are shown below.



Part A Explain what might happen to blood flow in the circulatory system if several arterial walls thicken this way.

If several arterial walls thicken this way, you could get high blood pressure.

Part B What effect will this thickening of arterial walls have on the heart?

The thickening of arterial walls could have a bad effect on the heart, such as, heart attacks, strocks, skipping beats, Etc.

STUDENT RESPONSE

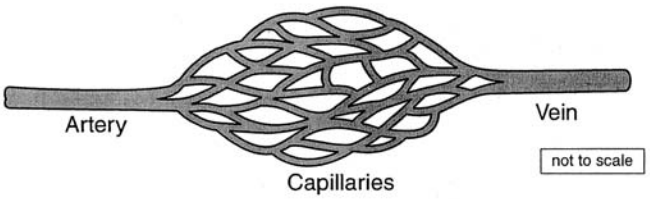
SCORE POINT
1

The response demonstrates partial understanding of the effects that arterial wall thickening can have on blood flow in the circulatory system and on the heart. The statement "you could get high blood pressure," neither adds to nor detracts from the demonstration of partial understanding. Although blood pressure can rise in response to arterial wall thickening, the response does not address the reduction in blood flow. The statement "bad effect on the heart, such as, heart attacks . . ." provides one correct effect that arterial wall thickening can have on the heart. A reduction in blood flow can cause a heart attack. "Strocks, skipping beats" are not effects on the heart. A stroke is an effect on the brain and heart rate is not regulated by blood flow.

STUDENT RESPONSE

READ
INQUIRE
EXPLAIN

The human circulatory system includes three types of blood vessels: arteries, capillaries, and veins. Fatty material can collect inside the arteries and over time the arterial walls will thicken with fatty deposits. An artery, capillaries, and a vein are shown below.



Part A Explain what might happen to blood flow in the circulatory system if several arterial walls thicken this way.

It Fights inFection, and it helps the heart. and the body of humans

Part B What effect will this thickening of arterial walls have on the heart?

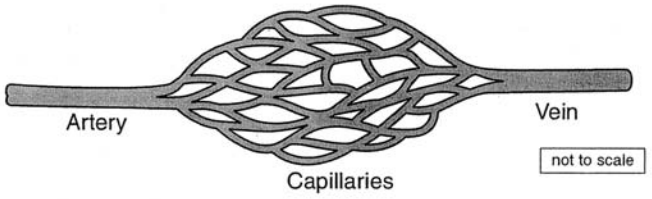
The heart would have blood and nutrients to survive.

SCORE POINT
0

The response demonstrates a lack of understanding of the effects that arterial wall thickening can have on blood flow in the circulatory system and on the heart. The statement "it Fights inFection, and it helps the heart. and the body of humans," does not explain the effect of arterial wall thickening on blood flow. It is not clear if this is a reference to blood or to arterial wall thickening; therefore, the response lacks sufficient information to determine understanding. The statement "The heart would have blood and nutrients to survive," does not explain an effect that arterial wall thickening can have on the heart, and demonstrates a clear misunderstanding of the underlying scientific concepts.

READ
INQUIRE
EXPLAIN

The human circulatory system includes three types of blood vessels: arteries, capillaries, and veins. Fatty material can collect inside the arteries and over time the arterial walls will thicken with fatty deposits. An artery, capillaries, and a vein are shown below.



Part A Explain what might happen to blood flow in the circulatory system if several arterial walls thicken this way.

If the arterial wall thickens that way then the blood in the circulatory system will thicken.

Part B What effect will this thickening of arterial walls have on the heart?

The thickening of arterial walls will protect the blood vessels and make your blood more healthy.

STUDENT RESPONSE

SCORE POINT
0

The response demonstrates a lack of understanding of the effects that arterial wall thickening can have on blood flow in the circulatory system and on the heart. The statement "blood in the circulatory system will thicken," is uninterpretable. The statement "The thickening of arterial walls will protect the blood vessels and make your blood more healthy," demonstrates a clear misunderstanding of the underlying scientific concepts. Arterial wall thickening does not protect the blood vessels or make the blood more healthy, but rather makes it more difficult for blood to flow through the arteries. No effect of arterial wall thickening on the heart is given.

Grade 11

Short-Response Performance Task

- Calculators are provided for Grade 11 students to use for FCAT Science.
- FCAT Science Reference Sheets with formulas and conversions and the Periodic Table of the Elements are provided for Grade 11 students. (See Appendix B.)

READ
INQUIRE
EXPLAIN

General Short-Response Scoring Rubric

Score	Description
2	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 the demonstration of a thorough understanding.
1	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	A score of zero indicates that the student has not provided a response or has provided a response that does not demonstrate an understanding of the scientific concepts and/or procedures embodied in the task. The student's explanation may be uninterpretable, lack sufficient information to determine the student's understanding, contain clear misunderstandings of the underlying scientific concepts and/or procedures, or may be incorrect.

Science Short-Response Performance Task from FCAT 2006

The strand, standard, and benchmark for the task are presented below along with the task as it appears in the FCAT 2006 test.

Description of Task

Strand A: The Nature of Matter

Standard 1: The student understands that all matter has observable, measurable properties.

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.

Performance Task: Eleventh grade students were directed to their answer books to respond to this question. The performance task below was reduced to fit on this page. The actual size is shown on the following page.

READ
INQUIRE
EXPLAIN

To produce sulfuric acid (H_2SO_4), one industrial plant uses the "contact process," which consists of several reactions. The initial reaction in this process uses sulfur dioxide (SO_2) and oxygen (O_2) in the presence of vanadium oxide (V_2O_5) pellets to produce sulfur trioxide (SO_3) as shown below.

$$2SO_2\ (g)\ \text{Sulfur dioxide} + O_2\ (g)\ \text{Oxygen} \xrightarrow{V_2O_5\ \text{Pellets}} 2SO_3\ (g)\ \text{Sulfur trioxide}$$

Part A In the reaction between SO_2 and O_2, what is the role of the V_2O_5 pellets?

Part B Explain what the industrial chemists could do to increase the efficiency of this reaction.

Example of a Top-Score Response for This Task

READ
INQUIRE
EXPLAIN

To produce sulfuric acid (H_2SO_4), one industrial plant uses the "contact process," which consists of several reactions. The initial reaction in this process uses sulfur dioxide (SO_2) and oxygen (O_2) in the presence of vanadium oxide (V_2O_5) pellets to produce sulfur trioxide (SO_3) as shown below.

$$2SO_2\ (g)\ \text{Sulfur dioxide} + O_2\ (g)\ \text{Oxygen} \xrightarrow{V_2O_5\ \text{Pellets}} 2SO_3\ (g)\ \text{Sulfur trioxide}$$

Part A In the reaction between SO_2 and O_2, what is the role of the V_2O_5 pellets?

An explanation similar to the following:

The vanadium oxide pellets serve as a catalyst in the reaction between SO_2 and O_2.

Part B Explain what the industrial chemists could do to increase the efficiency of this reaction.

An explanation similar to the following:

To increase the reaction's efficiency, the chemists could increase the temperature at which the reaction occurs.

READ
INQUIRE
EXPLAIN

To produce sulfuric acid (H_2SO_4), one industrial plant uses the "contact process," which consists of several reactions. The initial reaction in this process uses sulfur dioxide (SO_2) and oxygen (O_2) in the presence of vanadium oxide (V_2O_5) pellets to produce sulfur trioxide (SO_3) as shown below.

$$2SO_2\ (g)\ \text{Sulfur dioxide} + O_2\ (g)\ \text{Oxygen} \xrightarrow{V_2O_5\ \text{Pellets}} 2SO_3\ (g)\ \text{Sulfur trioxide}$$

Part A In the reaction between SO_2 and O_2, what is the role of the V_2O_5 pellets?

In the reaction between SO_2 and O_2 the vanadium oxide is used as a catalyst to cause the reaction to speed up.

Part B Explain what the industrial chemists could do to increase the efficiency of this reaction.

To increase the efficiency the chemist could increase the temperature at which the reaction is taking place which would cause more product to be produced at a faster rate.

STUDENT RESPONSE

SCORE POINT
2

The response demonstrates a thorough understanding of the role of a catalyst in a chemical reaction and how the efficiency of a chemical reaction can be increased. The statement "used as a catalyst to cause the reaction to speed up," clearly identifies vanadium oxide as a catalyst in the production of sulfur trioxide and demonstrates further understanding that catalysts increase the rate of reaction. The response correctly explains that the chemists "could increase the temperature." This is a scientifically sound method the chemists could use to increase the efficiency of the reaction. Increasing the temperature would increase the reaction rate, leading to increased efficiency. The statement "cause more product to be produced at a faster rate," is correct because more of the product that is produced will be produced at a faster rate when the temperature is increased. The response is clear and complete.

READ
INQUIRE
EXPLAIN

To produce sulfuric acid (H_2SO_4), one industrial plant uses the "contact process," which consists of several reactions. The initial reaction in this process uses sulfur dioxide (SO_2) and oxygen (O_2) in the presence of vanadium oxide (V_2O_5) pellets to produce sulfur trioxide (SO_3) as shown below.

$$2SO_2\ (g)\ \text{Sulfur dioxide} + O_2\ (g)\ \text{Oxygen} \xrightarrow{V_2O_5\ \text{Pellets}} 2SO_3\ (g)\ \text{Sulfur trioxide}$$

Part A In the reaction between SO_2 and O_2, what is the role of the V_2O_5 pellets?

the pellets speed up the reaction.

Part B Explain what the industrial chemists could do to increase the efficiency of this reaction.

To increase the efficiency of this reaction, the chemist could increase the temperature of the reactants involved in the equation.

STUDENT RESPONSE

SCORE POINT
2

The response demonstrates a thorough understanding of the role of a catalyst in a chemical reaction and how the efficiency of a chemical reaction can be increased. The statement "the pellets speed up the reaction," correctly explains that the role of the pellets is to increase the rate of reaction between sulfur dioxide and oxygen. The statement "the chemist could increase the temperature of the reactants . . . ," is a scientifically sound method of increasing the efficiency of the reaction. Increasing the temperature would increase the reaction rate, leading to increased efficiency. The response is clear and complete.

READ
INQUIRE
EXPLAIN

To produce sulfuric acid (H_2SO_4), one industrial plant uses the "contact process," which consists of several reactions. The initial reaction in this process uses sulfur dioxide (SO_2) and oxygen (O_2) in the presence of vanadium oxide (V_2O_5) pellets to produce sulfur trioxide (SO_3) as shown below.

$$2SO_2\ (g)\ \text{Sulfur dioxide} + O_2\ (g)\ \text{Oxygen} \xrightarrow{V_2O_5\ \text{Pellets}} 2SO_3\ (g)\ \text{Sulfur trioxide}$$

Part A In the reaction between SO_2 and O_2, what is the role of the V_2O_5 pellets?

Its role is to be a catalyst

Part B Explain what the industrial chemists could do to increase the efficiency of this reaction.

add heat and increase pressure.

STUDENT RESPONSE

SCORE POINT 2

The response demonstrates a thorough understanding of the role of a catalyst in a chemical reaction and how the efficiency of a chemical reaction can be increased. The response correctly identifies vanadium oxide as a catalyst in the production of sulfur trioxide by stating "Its role is to be a catalyst." The statement "add heat and increase pressure," provides two scientifically sound methods the chemists could use to increase the efficiency of the reaction. Adding heat and increasing pressure would both increase the reaction rate, leading to increased efficiency. The response is clear and complete.

READ
INQUIRE
EXPLAIN

To produce sulfuric acid (H_2SO_4), one industrial plant uses the "contact process," which consists of several reactions. The initial reaction in this process uses sulfur dioxide (SO_2) and oxygen (O_2) in the presence of vanadium oxide (V_2O_5) pellets to produce sulfur trioxide (SO_3) as shown below.

$$2SO_2\ (g) + O_2\ (g) \xrightarrow{V_2O_5\ \text{Pellets}} 2SO_3\ (g)$$

Sulfur dioxide + Oxygen → Sulfur trioxide

Part A In the reaction between SO_2 and O_2, what is the role of the V_2O_5 pellets?

The vanadium oxide (V_2O_5) pellets serve as a catalyst to speed up the reaction between SO_2 and O_2 to form SO_3. V_2O_5 also reduces the amount of activation energy needed to start the reaction.

Part B Explain what the industrial chemists could do to increase the efficiency of this reaction.

More of the pellets could be used to increase the rate of reaction of the 2 reactants. The more pellets used will allow more of the reactants in SO_2 be in contact with O_2.

STUDENT RESPONSE

SCORE POINT
2

The response demonstrates a thorough understanding of the role of a catalyst in a chemical reaction and how the efficiency of a chemical reaction can be increased. The response correctly identifies vanadium oxide as a catalyst in the production of sulfur trioxide by stating "The vanadium oxide (V_2O_5) pellets serve as a catalyst . . . ," and demonstrates further understanding of how catalysts increase the rate of reaction by stating "to speed up the reaction between SO_2 and O_2 to form SO_3. V_2O_5 also reduces the amount of activation energy needed to start the reaction." The statement "More of the pellets could be used . . . more pellets used will allow more of the reactants in SO_2 be in contact with O_2," provides a scientifically sound method the chemists could use to increase the efficiency of the reaction. Increasing the amount of vanadium oxide pellets will increase the rate of reaction, leading to increased efficiency. This response is clear and complete.

READ
INQUIRE
EXPLAIN

To produce sulfuric acid (H_2SO_4), one industrial plant uses the "contact process," which consists of several reactions. The initial reaction in this process uses sulfur dioxide (SO_2) and oxygen (O_2) in the presence of vanadium oxide (V_2O_5) pellets to produce sulfur trioxide (SO_3) as shown below.

$$2SO_2\ (g)\ \text{Sulfur dioxide} + O_2\ (g)\ \text{Oxygen} \xrightarrow{V_2O_5\ \text{Pellets}} 2SO_3\ (g)\ \text{Sulfur trioxide}$$

Part A In the reaction between SO_2 and O_2, what is the role of the V_2O_5 pellets?

The role played by the vanadium oxide pellets is a catalyst because it causes the reaction to take place and is used up in the process.

Part B Explain what the industrial chemists could do to increase the efficiency of this reaction.

Increase the heat and pressure applied to the reactants to increase the efficiency.

STUDENT RESPONSE

SCORE POINT
1

The response demonstrates partial understanding of the role of a catalyst in a chemical reaction and how the efficiency of a chemical reaction can be increased. The response correctly identifies vanadium oxide as a catalyst in the production of sulfur trioxide by stating "the vanadium oxide pellets is a catalyst." The statement "is used up in the process," demonstrates misunderstanding of the role of a catalyst, because catalysts are not consumed during a reaction. The statement "Increase the heat and pressure applied to the reactants to increase the efficiency," provides two methods the chemists could use to increase the efficiency of the reaction. Increasing both the heat and the pressure would increase the reaction rate, leading to increased efficiency.

READ
INQUIRE
EXPLAIN

To produce sulfuric acid (H_2SO_4), one industrial plant uses the "contact process," which consists of several reactions. The initial reaction in this process uses sulfur dioxide (SO_2) and oxygen (O_2) in the presence of vanadium oxide (V_2O_5) pellets to produce sulfur trioxide (SO_3) as shown below.

$$2SO_2\ (g) + O_2\ (g) \xrightarrow{V_2O_5\ \text{Pellets}} 2SO_3\ (g)$$

Sulfur dioxide + Oxygen → Sulfur trioxide

Part A In the reaction between SO_2 and O_2, what is the role of the V_2O_5 pellets?

The role of the vanadium oxide pellets are the main part for this compound

Part B Explain what the industrial chemists could do to increase the efficiency of this reaction.

Industrial chemists could increase the efficiency of this reaction if they would have to add more sulfur dioxide and oxygen.

STUDENT RESPONSE

SCORE POINT
1

The response demonstrates partial understanding of the role of a catalyst in a chemical reaction and how the efficiency of a chemical reaction can be increased. The statement "The role of the vanadium oxide pellets are the main part for this compound," is uninterpretable. It does not identify vanadium oxide as a catalyst in the production of sulfur trioxide or recognize that vanadium oxide increases the rate of reaction. The statement "add more sulfur dioxide and oxygen," is a scientifically sound method the chemists could use to increase the efficiency of the reaction. In this gas phase reaction, adding more reactants would increase their concentration. Increasing the concentration of the reactants would increase the rate of reaction, leading to increased efficiency.

READ
INQUIRE
EXPLAIN

To produce sulfuric acid (H_2SO_4), one industrial plant uses the "contact process," which consists of several reactions. The initial reaction in this process uses sulfur dioxide (SO_2) and oxygen (O_2) in the presence of vanadium oxide (V_2O_5) pellets to produce sulfur trioxide (SO_3) as shown below.

$$2SO_2\ (g)\ \text{Sulfur dioxide} + O_2\ (g)\ \text{Oxygen} \xrightarrow{V_2O_5\ \text{Pellets}} 2SO_3\ (g)\ \text{Sulfur trioxide}$$

Part A In the reaction between SO_2 and O_2, what is the role of the V_2O_5 pellets?

The vanadium oxide pellets act as a catalyst to facilitate and quicken the reaction between sulfur dioxide and oxygen.

Part B Explain what the industrial chemists could do to increase the efficiency of this reaction.

To increase this reaction's efficiency, chemists could think of some way to reuse the remains of the vanadium pellets.

STUDENT RESPONSE

SCORE POINT
1

The response demonstrates partial understanding of the role of a catalyst in a chemical reaction and how the efficiency of a chemical reaction can be increased. The statement "pellets act as a catalyst to Facilitate and quicken the reaction between sulfur dioxide and oxygen," clearly identifies vanadium oxide as a catalyst in the production of sulfur trioxide and demonstrates further understanding that catalysts increase the rate of reaction. The statement "chemists could think of some way to reuse the remains of the vanadium pellets," demonstrates the misunderstanding that the vanadium oxide catalyst would be consumed in the reaction and does not address how to increase the efficiency of this reaction.

READ
INQUIRE
EXPLAIN

To produce sulfuric acid (H_2SO_4), one industrial plant uses the "contact process," which consists of several reactions. The initial reaction in this process uses sulfur dioxide (SO_2) and oxygen (O_2) in the presence of vanadium oxide (V_2O_5) pellets to produce sulfur trioxide (SO_3) as shown below.

$$2SO_2\ (g)\ \text{Sulfur dioxide} + O_2\ (g)\ \text{Oxygen} \xrightarrow{V_2O_5\ \text{Pellets}} 2SO_3\ (g)\ \text{Sulfur trioxide}$$

Part A In the reaction between SO_2 and O_2, what is the role of the V_2O_5 pellets?

The pellets are used to speed up the reaction time between sulfur and oxygen elements.

Part B Explain what the industrial chemists could do to increase the efficiency of this reaction.

To increase efficiency, the industrial chemists could perform numerous experiements on the reaction

STUDENT RESPONSE

SCORE POINT
1

The response demonstrates partial understanding of the role of a catalyst in a chemical reaction and how the efficiency of a chemical reaction can be increased. The statement "The pellets are used to speed up the reaction time between sulfur and oxygen elements," correctly explains that the role of the pellets is to increase the rate of reaction between SO_2 and O_2. The identification of the reactants as sulfur and oxygen rather than sulfur dioxide and oxygen is a minor flaw that does not detract from the demonstration of partial understanding. The statement "the industrial chemists could perform numerous experiements on the reaction," does not address or explain a method the chemists could use to increase the efficiency of the reaction.

READ
INQUIRE
EXPLAIN

To produce sulfuric acid (H_2SO_4), one industrial plant uses the "contact process," which consists of several reactions. The initial reaction in this process uses sulfur dioxide (SO_2) and oxygen (O_2) in the presence of vanadium oxide (V_2O_5) pellets to produce sulfur trioxide (SO_3) as shown below.

$$2SO_2\ (g)\ \text{Sulfur dioxide} + O_2\ (g)\ \text{Oxygen} \xrightarrow{V_2O_5\ \text{Pellets}} 2SO_3\ (g)\ \text{Sulfur trioxide}$$

Part A In the reaction between SO_2 and O_2, what is the role of the V_2O_5 pellets?

The vanadium oxide pellets help sulfur dioxide and oxygen to combine to form sulfur trioxide. The O_2 is subtracted from V_2O_5 to get the O_3 in $2SO_3$.

Part B Explain what the industrial chemists could do to increase the efficiency of this reaction.

The industrial chemists could increase the amount of oxygen to increase the efficiency of this reaction. Or the industrial chemists could use another process besides the "contact process" to produce $2SO_3$.

STUDENT RESPONSE

SCORE POINT
0

The response demonstrates a lack of understanding of the role of a catalyst in a chemical reaction and how the efficiency of a chemical reaction can be increased. The statement "pellets help sulfur dioxide and oxygen to combine to form sulfur trioxide," does not identify the role of the V_2O_5 pellets. The statement "The O_2 is subtracted from V_2O_5 to get the O_3 in $2SO_3$," demonstrates misunderstanding about the role of the V_2O_5 and identifies it as a reactant rather than a catalyst. The statement "could increase the amount of oxygen . . . ," does not address a method the chemists could use to increase the efficiency of this reaction. Increasing only one of the reactants would not increase the reaction rate or lead to increased efficiency. Both reactants would need to be increased in order for reaction rate to increase, since one reactant would act as a limiting reagent. The statement "use another process besides the 'contact process' to produce $2SO_3$," is not correct because it would require the chemists to use a different reaction and would not increase the efficiency of the reaction given.

READ
INQUIRE
EXPLAIN

To produce sulfuric acid (H_2SO_4), one industrial plant uses the "contact process," which consists of several reactions. The initial reaction in this process uses sulfur dioxide (SO_2) and oxygen (O_2) in the presence of vanadium oxide (V_2O_5) pellets to produce sulfur trioxide (SO_3) as shown below.

$$2SO_2\ (g)\ \text{Sulfur dioxide} + O_2\ (g)\ \text{Oxygen} \xrightarrow{V_2O_5\ \text{Pellets}} 2SO_3\ (g)\ \text{Sulfur trioxide}$$

Part A In the reaction between SO_2 and O_2, what is the role of the V_2O_5 pellets?

The role of the vanadium oxide pellets between the reaction between SO_2 and O_2 is that it acts as a source of energy to facilitate the fusion of $2SO_2$ and O_2, to become $2SO_3$.

Part B Explain what the industrial chemists could do to increase the efficiency of this reaction.

What the industrial chemists can do to increase the efficiency of this reaction, is that they can use catalysts to increase the rate of reaction so more sulfur trioxide can be produced in a shorter amount of time, which in turn helps to produce more output, bringing in more money.

STUDENT RESPONSE

SCORE POINT
0

The response demonstrates a lack of understanding of the role of a catalyst in a chemical reaction and how the efficiency of a chemical reaction can be increased. The statement "vanadium oxide pellets . . . acts as a source of energy to facilitate the fusion of $2SO_2$ and O_2 . . . ," does not identify vanadium oxide as a catalyst in the production of sulfur trioxide or recognize that vanadium oxide increases the rate of reaction. This statement also demonstrates the misconception that the pellets act as a source of energy, rather than lowering the activation energy of the reaction. The statement "they can use catalysts to increase the rate of reaction . . . ," demonstrates a lack of understanding that a catalyst is already present in this reaction.

Appendix A
FCAT Science Short-Response Rubric

READ
INQUIRE
EXPLAIN

General Short-Response Scoring Rubric

Score	Description
2	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 the demonstration of a thorough understanding.
1	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	A score of zero indicates that the student has not provided a response or has provided a response that does not demonstrate an understanding of the scientific concepts and/or procedures embodied in the task. The student's explanation may be uninterpretable, lack sufficient information to determine the student's understanding, contain clear misunderstandings of the underlying scientific concepts and/or procedures, or may be incorrect.

FCAT Science Extended-Response Rubric

READ
INQUIRE
EXPLAIN

General Extended-Response Scoring Rubric

Score	Description
4	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	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	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	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	A score of zero indicates that the student has not provided a response or has provided a response that does not demonstrate an understanding of the scientific concepts and/or procedures embodied in the task. The student's explanation may be uninterpretable, lack sufficient information to determine the student's understanding, contain clear misunderstandings of the underlying scientific concepts and/or procedures, or may be incorrect.

Appendix B

Grade 8 FCAT Science Reference Sheet

Equations

Acceleration (a)	=	$\frac{\text{change in velocity (m/s)}}{\text{time taken for this change (s)}}$	a	=	$\frac{v_f - v_i}{t_f - t_i}$
Average speed (v)	=	$\frac{\text{distance}}{\text{time}}$	v	=	$\frac{d}{t}$
Density (D)	=	$\frac{\text{mass (g)}}{\text{Volume (cm}^3\text{)}}$	D	=	$\frac{m}{V}$
Percent Efficiency (e)	=	$\frac{\text{Work out (J)}}{\text{Work in (J)}} \times 100$	%e	=	$\frac{W_{out}}{W_{in}} \times 100$
Force (F)	=	mass (kg) × acceleration (m/s^2)	F	=	ma
Frequency (f)	=	$\frac{\text{number of events (waves)}}{\text{time (s)}}$	f	=	$\frac{n \text{ of events}}{t}$
Momentum (p)	=	mass (kg) × velocity (m/s)	p	=	mv
Wavelength (λ)	=	$\frac{\text{velocity (m/s)}}{\text{frequency (Hz)}}$	λ	=	$\frac{v}{f}$
Work (W)	=	Force (N) × distance (m)	W	=	Fd

Units of Measure

m = meter	g = gram	s = second
cm = centimeter	kg = kilogram	Hz = hertz (waves per second)
J = joule (newton-meter)		
N = newton (kilogram-meter per second squared)		

Appendix B

Grade 11 FCAT Science Reference Sheet

Equations

Acceleration (a)	=	$\frac{\text{change in velocity (m/s)}}{\text{time taken for this change (s)}}$	a	=	$\frac{v_f - v_i}{t_f - t_i}$
Average speed (v)	=	$\frac{\text{distance}}{\text{time}}$	v	=	$\frac{d}{t}$
Density (D)	=	$\frac{\text{mass (g)}}{\text{Volume (cm}^3\text{)}}$	D	=	$\frac{m}{V}$
Percent Efficiency (e)	=	$\frac{\text{Work out (J)}}{\text{Work in (J)}} \times 100$	%e	=	$\frac{W_{out}}{W_{in}} \times 100$
Force (F)	=	mass (kg) × acceleration (m/s^2)	F	=	ma
Frequency (f)	=	$\frac{\text{number of events (waves)}}{\text{time (s)}}$	f	=	$\frac{n \text{ of events}}{t}$
Momentum (p)	=	mass (kg) × velocity (m/s)	p	=	mv
Pressure (P)	=	$\frac{\text{Force (N)}}{\text{area (m}^2\text{)}}$	P	=	$\frac{F}{A}$
Wavelength (λ)	=	$\frac{\text{velocity (m/s)}}{\text{frequency (Hz)}}$	λ	=	$\frac{v}{f}$
Work (W)	=	Force (N) × distance (m)	W	=	Fd

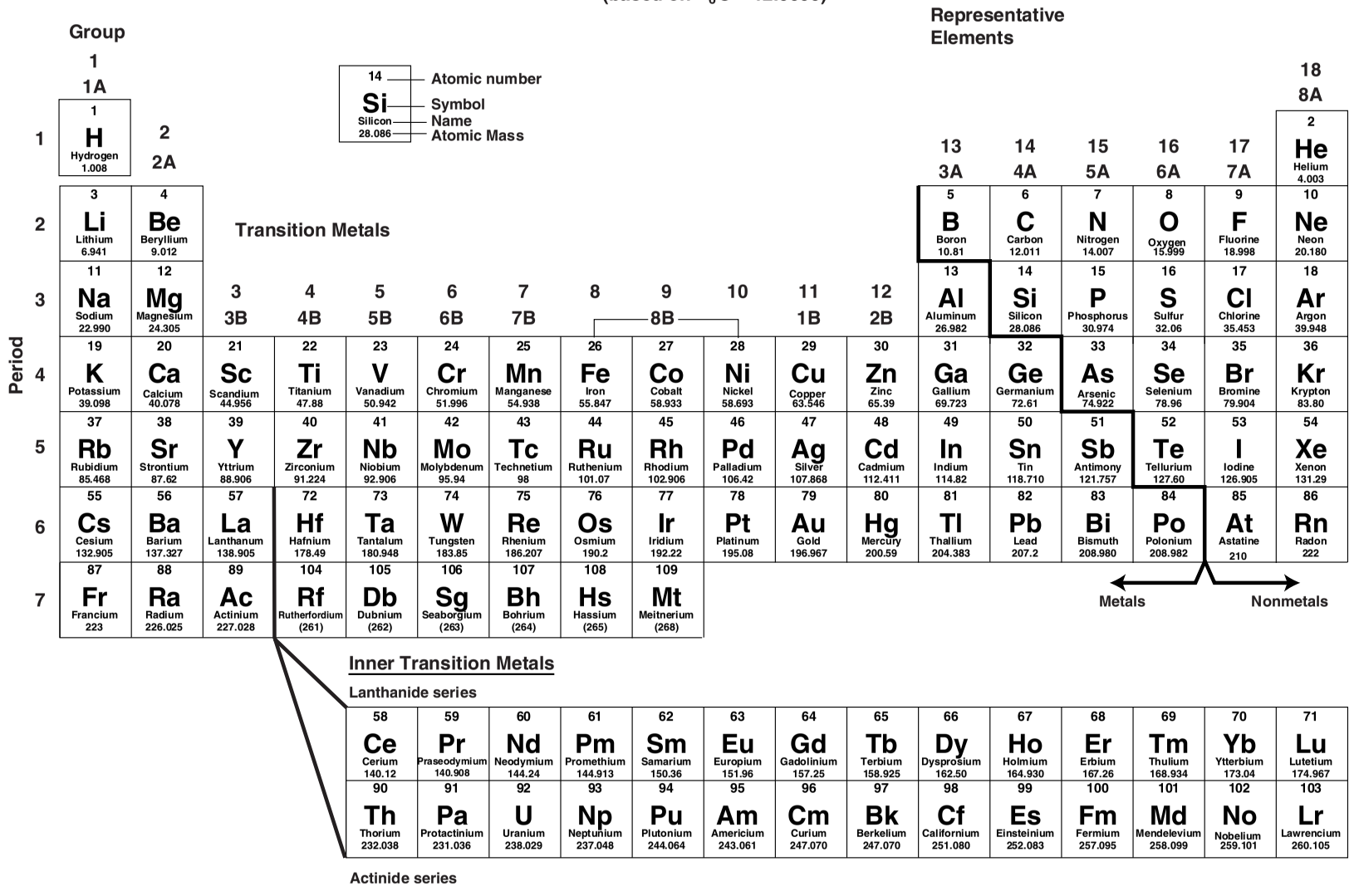
Units of Measure

m = meter
cm = centimeter
g = gram
kg = kilogram
s = second
Hz = hertz (waves per second)
J = joule (newton-meter)
N = newton (kilogram-meter per second squared)

1 Astronomical Unit (AU) = distance between Earth and the Sun (approximately 150 million kilometers)

Periodic Table of the Elements

(based on $^{12}_{6}C = 12.0000$)



Group	1 1A	2 2A	3 3B	4 4B	5 5B	6 6B	7 7B	8	9 8B	10	11 1B	12 2B	13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1	1 H Hydrogen 1.008																	2 He Helium 4.003
2	3 Li Lithium 6.941	4 Be Beryllium 9.012											5 B Boron 10.81	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180
3	11 Na Sodium 22.990	12 Mg Magnesium 24.305											13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.06	17 Cl Chlorine 35.453	18 Ar Argon 39.948
4	19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.88	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.847	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.723	32 Ge Germanium 72.61	33 As Arsenic 74.922	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
5	37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.906	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.82	50 Sn Tin 118.710	51 Sb Antimony 121.757	52 Te Tellurium 127.60	53 I Iodine 126.905	54 Xe Xenon 131.29
6	55 Cs Cesium 132.905	56 Ba Barium 137.327	57 La Lanthanum 138.905	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.2	77 Ir Iridium 192.22	78 Pt Platinum 195.08	79 Au Gold 196.967	80 Hg Mercury 200.59	81 Tl Thallium 204.383	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium 208.982	85 At Astatine 210	86 Rn Radon 222
7	87 Fr Francium 223	88 Ra Radium 226.025	89 Ac Actinium 227.028	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (263)	107 Bh Bohrium (264)	108 Hs Hassium (265)	109 Mt Meitnerium (268)									

Lanthanide series	58 Ce Cerium 140.12	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.24	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.50	67 Ho Holmium 164.930	68 Er Erbium 167.26	69 Tm Thulium 168.934	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
Actinide series	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.080	99 Es Einsteinium 252.083	100 Fm Fermium 257.095	101 Md Mendelevium 258.099	102 No Nobelium 259.101	103 Lr Lawrencium 260.105

Appendix B
Grades 8 & 11 FCAT Science
Periodic Table of the Elements

Appendix C
Scorer Bias

Scorer bias refers to factors that have no basis in the scoring criteria or rubric, but have an effect on a scorer's perception of a student's response. Scorers are trained to avoid these biases because research indicates that biases can interfere with a consistent application of the scoring rubric.

1. **Reactions to Scoring Criteria from Other Assessments, Previous Experience with Instruction, or the Use of the Test or Test Scores.** Do you prefer the scoring criteria of another project, state, or grade level? Do you have an issue with instruction, the appropriateness of the rubric, the soundness of the administration, or the use of the assessment? Your role is to score the responses according to the scoring criteria rather than to react to the scoring criteria, administration procedures, or the use of the assessment.
2. **Appearance of Response.** How does the paper look at first glance? How long is the response? You should not be influenced by handwriting, neatness, and margins. Handwriting ability is not the same as writing ability. The scoring criteria are based on the quality of the response rather than on the appearance of the response.
3. **Knowledge of Topic.** Are you knowledgeable about the topic? When evaluating student responses, you should consistently adhere to the scoring criteria, regardless of your expertise (or lack of expertise) about the topic.
4. **Reactions to Style.** Does the student begin sentences with "And" or "But"; use an informal tone; use first person; use clichés; place the thesis statement in the conclusion rather than in the introduction; use one-sentence paragraphs; or choose a formulaic, a traditional, or a non-traditional organizational structure? Does the use of a particular stylistic or organizational method prejudice your scoring? Are you unduly influenced by the use of one well-turned phrase in what otherwise is a non-illustrative response? Florida's scoring criteria do not mandate a particular style or organizational structure.
5. **Reactions to Content.** Has the student used vulgar or violent content? Is the response mundane? Does the student include information that either subtly or directly identifies the student's culture, ethnicity, religion, gender, sexual preference, or exceptionality? Does the student come across as brash, shy, cute, honest, willing to take a chance, or being like (or unlike) you were at that age? Your views about any of the preceding should never influence your scoring of a response. You should judge the student's ability to communicate, not the student's personality or voice. All scores must reflect the scoring criteria.
6. **Transference in Scoring.** Have many responses looked very similar? Is your scoring prejudiced by previously scored responses? In spite of the sameness or uniqueness of responses, an individual student wrote each response. You are responsible for applying the scoring criteria to each response as if it is the only response. Your judgment of a paper should never be influenced by the characteristics and quality of a previously scored paper.
7. **Well-being of Scorer.** Is your physical or mental state impeding your scoring accuracy? Each student's score must reflect the scoring criteria and not your state of mind, state of health, or state of rest.

Resources
FCAT Publications and Products

The Department of Education produces many materials to help educators, students, and parents better understand the FCAT program. A list of FCAT-related publications and products is provided below. Additional information about the FCAT program is available on the FCAT home page of the DOE web site at http://www.fldoe.org.

About the FCAT Web Brochure

This web-based brochure is found on the DOE web site in English, Spanish, and Haitian Creole and provides information about FCAT Reading, Writing+, Mathematics, and Science for Grades 3–11. It is designed to provide an overview as well as detailed information across grades and subject areas and to link the reader to other helpful DOE web resources.

Assessment & Accountability Briefing Book

This book provides an overview of Florida's assessment, school accountability, and teacher certification programs. FCAT topics include frequently asked questions, content assessed by the FCAT, reliability, and validity. This booklet can be downloaded from the DOE web site.

FCAT Handbook—A Resource for Educators

This publication provides the first comprehensive look at the FCAT, including history, test content, test format, test development and construction, test administration, and test scoring and reporting. Educator involvement is emphasized, demonstrating how Florida teachers and administrators participate in reviewing test items, determining how standards should be assessed, finding ranges of scores, and providing input on aspects of the test administration process. The PDF version is available on the DOE web site.

FCAT Myths vs. Facts

By providing factual information about the FCAT program, this brochure addresses common concerns about the FCAT that are based on myths. It is also available in Spanish and can be downloaded from the DOE web site.

FCAT Performance Task Scoring—Practice for Educators (publications and software)

These materials are designed to help teachers learn to score FCAT Reading, Writing, and Mathematics performance tasks at Grades 4, 5, 8, and 10. A *Trainer's Guide* includes instructions for using the scoring publications and software in teacher education seminars and workshops. The publications mirror the scorer training experiences by presenting samples of student work for teachers to score.

FCAT Posters

Newly designed 17" by 23" elementary, middle, and high school FCAT Reading, Writing+, Science, and Mathematics posters have an instructional focus. Two additional posters provide information about achievement levels and which FCAT tests are given at each grade. A high school poster reminds students about the graduation requirement to pass the FCAT Reading and Mathematics tests and the multiple opportunities available to retake the tests. New posters were delivered to districts in August 2005 and are available at the district assessment offices.

FCAT Released Tests

Reading, Grades 4, 8, and 10
Mathematics, Grades 4, 8, and 10

In 2005, the DOE released previously used full tests of FCAT Reading and FCAT Mathematics for Grades 4, 8, and 10. This web-based release included not only the tests, but also several other important documents including: answer keys, *How to Use the FCAT Released Tests, How to Score the FCAT Released Tests,* and *Frequently Asked Questions about the FCAT Released Tests.* These supplemental materials provide many details about the FCAT that are informative for all audiences, especially the range of correct answers and points needed for each achievement level. All materials are available on the DOE web site.

FCAT Results Folder: A Guide for Parents and Guardians

This folder is designed for parents and guardians of students in Grades 3–11. It provides information about FCAT student results and allows parents to store student reports for future reference. Spanish and Haitian Creole versions are available. Delivery coincides with the spring delivery of student reports.

FCAT Test Item Specifications

Reading, Grade Levels 3–5, 6–8, and 9–10
Mathematics, Grade Levels 3–5, 6–8, and 9–10
Science, Grades 5, 8, and 10
Writing+ draft versions, Grades 4, 8, and 10

Defining both the content and the format of the FCAT test questions, the *Specifications* primarily serve as guidelines for item writers and reviewers, but also contain information for educators and the general public. The *Specifications* are designed to be broad enough to ensure test items are developed in several formats to measure the concepts presented in each benchmark. These materials can be downloaded from the DOE web site.

Florida Reads! Report on the 2006 FCAT Reading Released Items (Grades 4, 8 & 10)
Florida Solves! Report on the 2006 FCAT Mathematics Released Items (Grades 5, 8 & 10)
Florida Inquires! Report on the 2006 FCAT Science Released Items (Grades 5, 8 & 11)

These reports provide information about the scoring of the FCAT Reading, Mathematics, and Science performance tasks displayed on the 2006 student reports. *Florida Reads!* combines Grades 4, 8, and 10 in one document; *Florida Solves!* covers Grades 5, 8, and 10; and *Florida Inquires!* includes Grades 5, 8, and 11. The reports are available each May.

Florida Writes! Report on the 2006 FCAT Writing+ Assessment, Grade 4
Florida Writes! Report on the 2006 FCAT Writing+ Assessment, Grade 8
Florida Writes! Report on the 2006 FCAT Writing+ Assessment, Grade 10

Each grade-level publication describes the content and application of the FCAT Writing+ tests and offers suggestions for activities that may be helpful in preparing students for the assessments. The reports are available each May.

Frequently Asked Questions About FCAT

This brochure provides answers to frequently asked questions about the FCAT program and is available on the DOE web site.

Keys to FCAT, Grades 3–5, 6–8, and 9–11

These booklets are distributed each January and contain information for parents and students preparing for FCAT Reading, Writing+, Mathematics, and Science. *Keys to FCAT* are translated into Spanish and Haitian Creole and are available, along with the English version, on the DOE web site.

Lessons Learned—FCAT, Sunshine State Standards and Instructional Implications

This document provides an analysis of previous years' FCAT results and contains analyses of FCAT Reading, Writing, and Mathematics state-level data through 2000. The analysis will assist educators in interpreting and understanding their local FCAT scores, which will help improve instruction in the classroom. The PDF version is available on the DOE web site.

Sample Test Materials for the FCAT
Reading and Mathematics, Grades 3–10
Science, Grades 5, 8, and 11
Writing+, Grades 4, 8, and 10

These materials are produced and distributed each fall for teachers to use with students. The student's test booklet contains a list of the different kinds of FCAT questions, practice questions, and hints for answering them. The teacher's answer key provides the correct answer, an explanation for the correct answer, and also indicates which Sunshine State Standards benchmark is being assessed by each question. These booklets are available in PDF format on the DOE web site.

The New FCAT NRT: Stanford Achievement Test, Tenth Edition (SAT10)

This brochure outlines differences between the previous FCAT NRT (SAT9) and the current FCAT NRT (SAT10) and provides specifications of the classifications and composition of the Reading and Mathematics NRT assessments. It is available in PDF format on the DOE web site.

Understanding FCAT Reports

This booklet provides information about the FCAT student, school, and district reports for the recent test administration. Samples of reports, explanations about the reports, and a glossary of technical terms are included. Distribution to districts is scheduled to coincide with the delivery of student reports each May. The booklet can be downloaded from the DOE web site.

What every teacher should know about FCAT

This document provides suggestions for all subject-area teachers to use in helping their students be successful on the FCAT. It can be downloaded from the DOE web site.

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