The Pennsylvania System of School Assessment

Science, Technology, Environment, and Ecology Assessment Handbook

Pennsylvania Department of Education
Division of Evaluation and Reports

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INTRODUCTION

The Pennsylvania System of School Assessment (PSSA) assesses students to provide information about achievement at student, school, and district levels. During the 1998–1999 school year, the System began assessing the Pennsylvania Academic Standards for the first time in the areas of math, reading, and writing.

This handbook focuses on the anticipated 2003–2004 Science, Technology, Environment, and Ecology (STEE) Assessment. The STEE Assessment was designed to assess school and student performance on STEE Academic Standards, which are part of Appendix B in Chapter 4 of the Pennsylvania School Code. Assessment handbooks are also available for mathematics, reading, and writing. (For these handbooks, please go to the Department of Education Web site: http://www.pde.state.pa.us/. Once there, please click on K-12 Schools, then Assessment and Testing for access to these files.) Those subject area assessment handbooks contained an appendix entitled "Testing Accommodations to Encourage Participation by Students with Disabilities in the Pennsylvania System of School Assessment." This information may now be found on the Department of Education Web site as well.

Individual districts, buildings, and teachers play an essential role in teaching and assessing the Pennsylvania STEE Standards at the local level. In teaching to the Standards, many Pennsylvania educators follow the constructivist model of instruction. This attempt to provide a hands-on STEE program of instruction is to be commended. At all levels, it is important to remember that curriculum, instruction, and assessment should focus on meeting the standard statement. Further, meeting the STEE Standards should be approached as a collaborative effort among all curricular areas. While the STEE Assessment is not in itself hands-on, many of the assessment questions are written with the understanding that Pennsylvania schools should have a hands-on STEE education program.

PERMISSION TO REPRINT

OVERVIEW OF THE PSSA AND STEE ASSESSMENTS

On October 21, 1998, the Pennsylvania State Board of Education adopted final-form regulations for the new Chapter 4 of the Pennsylvania School Code. After the regulatory review process, it was published in the January 16, 1999, *Pennsylvania Bulletin* as final rulemaking, binding on all public schools in the Commonwealth.

The new Chapter 4 replaced the previously adopted Chapters 3 and 5 and provided a new direction for the PSSA. Beginning with the 1998–1999 Assessment, the PSSA became standards-based. This means that, beginning with the February/March 1999 testing, all of the PSSA had to align with the Pennsylvania Academic Standards. The movement to standards was adopted as a major focus of the Chapter 4 regulations, and those for mathematics and reading, writing, speaking, and listening were included as an appendix to Chapter 4. These standards have been widely distributed and can be found on the PDE Web site, http://www.pde.state.pa.us/.

On January 5, 2002, academic standards for Science and Technology and Environment and Ecology (STEE) were adopted as an Appendix to Chapter 4. In accordance with the requirements of Chapter 4.51 relating to the implementation of PSSA and Act 16 of 1999 (Senate Bill 652 adopted on May 10, 2000) relating to Education Empowerment, PDE is developing an assessment for both standards' documents, PA *Academic Standards for Science and Technology* and PA *Academic Standards for Environment and Ecology*.

As outlined in Chapter 4, the purposes of the statewide assessment component of the PSSA are now the following:

1. Provide students, parents, educators, and citizens with an understanding of student and school performance.

2. Determine the degree to which school programs enable students to attain proficiency of academic standards.

3. Provide results to school districts (including charter schools) and approved area vocational technical schools (AVTSs) for consideration in the development of strategic plans.

4. Provide information to state policymakers including the General Assembly and the Board on how effective schools are in promoting and demonstrating student proficiency of academic standards.

5. Provide information to the general public on school performance.

6. Provide results to school districts (including charter schools) and AVTSs based upon the aggregate performance of all students. In compliance with federal regulations, disaggregated results are provided for certain student categories.

Although Mathematics and Reading Standards were adopted at the grade 3, 5, 8, and 11 levels, Chapter 4 called for the statewide assessment system to include only grades 5, 8, and 11 for these areas. STEE Standards were adopted for grades 4, 7, 10, and 12. The statewide assessment for these STEE Standards will be in grades 4, 7, and 10. Local school districts are responsible for assessing the grade 12 STEE Standards, even though there is not a State assessment for them. The STEE Assessments will take place in the spring of each school year.

Chapter 4 also adopted Writing Standards at the grade 3, 5, 8, and 11 levels; however, Chapter 4 directs that students' writing skills be assessed statewide in grades 6, 9, and 11. For this, PSSA Writing Assessments are administered. Near the beginning of each school year, students in grades 6 and 9 now (beginning 2002–2003) write three essays (Informational, Narrative, and Persuasive); about midway through the school year, students in grade 11 also write three essays (Informational, Narrative, and Persuasive).

Some statewide assessments use a combination of census testing and matrix sampling procedures. Census testing requires all students to complete the same set of Selected Response (SR) "multiple-choice" items and Constructed Response (CR) "open-ended questions." Matrix sampling divides a large set of items, both SR and CR, into several different test forms with an equal number of items on all forms. Matrix sampling limits the time required for assessment, provides for consistent administration procedures, and reflects broad curriculum content.

As part of each test form in reading, mathematics, and STEE, students are asked to respond to SR items. They also are asked to respond in writing to questions about reading passages, to explain, in writing, how they arrived at solutions to mathematics problems, and students will also be asked in the STEE Assessments to explain, in writing, their understanding of STEE concepts. These CR questions, or performance assessments, are included so that students may explain how and what they are thinking and doing to solve problems.

THE STEE ASSESSMENT DEVELOPMENT

ADVISORY COMMITTEE

Advisory committees of Pennsylvania educators play a major role in the development of all PSSA Assessment measures. Division of Evaluation and Reports personnel have been greatly assisted in the development of assessment measures by a group of K-16 STEE teachers, supervisors, and other educators who constitute the STEE Assessment Advisory Committee (STEEAAC). This committee has written and reviewed most of the SR and CR tasks included in the assessment. The committee has also helped develop general rubrics for the CR tasks, provided assistance in categorizing items within the assessment framework, and reviewed items for bias and technical accuracy. More than 170 persons from across the state have helped develop the assessment measures described in this document. A list of current STEEAAC members is in Appendix A.

ACADEMIC STANDARDS FOR STEE

As a function of the adoption of Chapter 4, the content included in the 1998–1999 PSSA and in all those occurring after had to be based upon the framework specified by the Pennsylvania Academic Standards. The standards are stored in their entirety on the Web (http://www.pde.state.pa.us/). The entire listing of content categories for science and technology grades 4, 7, 10, and 12 is 33 pages; for environment and ecology, it is 23 pages. Pages 4 through 6 of this handbook list and describe the STEE academic standard categories. This list was taken directly from the table of contents preceding the standards.

ASSESSING STANDARD CONTENT

As an example of a standard category, the standard category 3.2, Inquiry and Design, is shown in Figure 1 on pages 8 and 9 with its standard statements (i.e., the statements listed as A, B, C, etc.). **Standard Category 3.2 was selected to serve as the example to emphasize the importance of these processes being fundamental to all STEE educational programs.** Figure 1 is illustrative of all standard statements in order to describe how the broader standard categories are being assessed.

As explained in the introduction of the Academic Standards, the standard categories are divided into standard statements. Each statement is preceded by a capital letter. For example, 3.2.A Inquiry and Design, grade 12, states, "Evaluate the nature of scientific and technological knowledge." Copying directly from the Standards document:

> **Following the standard statements are bulleted standard descriptors, which explain the nature and scope of the standard. Descriptors specify the nature of the standard and the level of complexity needed in meeting that standard in a proficient manner. Descriptors serve to benchmark the standard statement. *Curriculum, instruction and assessment should focus on meeting the standard statement … Meeting standards should be approached as a collaborative effort among all curricular areas*.** (emphasis added by STEEAAC)

It can be seen that the standard statements are printed as a progressive list across grade levels. Students at the grade 12 level are responsible for knowing all of the content shown at all grade levels; those at the grade 10 level are responsible for knowing the content listed for grades 10, 7, and 4, and so on. The assessment for a particular grade level includes content listed at that grade level and may include content for the grade levels below it. No content for the grade level(s) above an assessed level will appear on that grade level's assessment.

When developing STEE assessment items that align to standards, STEEAAC members were directed to write items to assess student achievement for each *standard statement* at a specific grade level. The bullets underneath each standard statement were used as additional guidelines, but were not required.

A quick review of the standards statements leads to the accurate conclusion that they were written for the classroom rather than in a format readily conducive to state-level assessment. Verbs such as explain, demonstrate, analyze, and describe appear throughout the statements. Students' abilities to carry out the great majority of these actions can be assessed in a paper and pencil format, but only through the use of CR items. Since the number of such items is limited by the time they take to administer and score, only a few can be used at any one time. To assess as many statements as possible, the approach taken is to change the verb to one that is capable of being assessed with SR questions. In SR questions, students are asked to choose the correct explanation rather than to explain, and to determine which is a correct demonstration rather than to demonstrate.

Pennsylvania's Science and Technology Standard Category 3.2 contains an important message by virtue of grouping Inquiry and Design together. Students must consistently be engaged in these creative endeavors in STEE to truly comprehend this aspect of learning. *Individual districts, buildings, and teachers play an essential role in the creation and assessment of inquiry and design capabilities. These processing skills are inherently both hands-on and of high cognitive level. The best evidence of scientific inquiry is by definition, conducting inquiry. Likewise, the best evidence of design is the design process.* For assistance in developing meaningful, hands-on units that make use of the constructivist model of instruction, teachers will find their district's *Science & Technology and Environmental & Ecology Classroom Connections* kits useful.

ACADEMIC STANDARD CATEGORIES

Science and Technology

3.1 Unifying Themes

Systems
Models
Patterns
Scale
Change

3.2 Inquiry and Design

Nature of Scientific Knowledge
Process Knowledge
Scientific Method
Problem Solving in Technology

3.3 Biological Sciences

Living Forms
Structure and Function
Inheritance
Evolution

3.4 Physical Science, Chemistry, and Physics

Matter
Energy
Forces and Motion
Astronomy

3.5 Earth Sciences

Land Forms and Processes
Resources
Meteorology
Hydrology
Oceanography

3.6 Technology Education

Biotechnology
Information Technology
Physical Technologies (Construction, Manufacturing, and Transportation)

3.7 Technological Devices

Tools
Instrument
Computer Operations
Computer Software
Computer Communications Systems

3.8 Science, Technology, and Human Endeavors

Constraints
Meeting Human Needs
Consequences and Impacts

Ecology and Environment

4.1 Watersheds and Wetlands

Cycles
Role of Watersheds
Physical Factors
Characteristics and Functions of Wetlands
Impacts of Watershed and Wetlands

4.2 Renewable and Nonrenewable Resources

Uses
Availability
Management
Influential Factors

4.3 Environmental Health

Environmental Health Issues
Human Actions
Biological Diversity

4.4 Agriculture and Society

Society’s Needs
Agricultural Science
Agricultural Systems
Technology

4.5 Integrated Pest Management

Effects, Benefits, and Impact
Health Risks
Management Practices

4.6 Ecosystems and Their Interactions

Living and Nonliving Components
Cycles
Change Over Time

4.7 Threatened, Endangered, and Extinct Species

Diversity
Adaptation
Management Strategies

4.8 Humans and the Environment

Societal Needs
Sustainability
Human Impacts
Supply and Demand

4.9 Environmental Laws and Regulations

Environmental Laws and Their Impact

Figure 1
Academic Standards for Science and Technology

3.2 Inquiry and Design			
3.2.4. Grade 4	3.2.7. Grade 7	3.2.10. Grade 10	3.2.12. Grade 12
Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to...			
A. Identify and use the nature of scientific and technological knowledge. • Distinguish between a scientific fact and a belief. • Provide clear explanations that account for observations and results. • Relate how new information can change existing perceptions. B. Describe objects in the world using the five senses. • Recognize observational descriptors from each of the five senses (e.g., see-blue, feel-rough). • Use observations to develop a descriptive vocabulary. C. Recognize and use the elements of scientific inquiry to solve problems. • Generate questions about objects, organisms and/or events that can be answered through scientific investigations. • Design an investigation. • Conduct an experiment. • State a conclusion that is consistent with the information. D. Recognize and use the technological design process to solve problems. • Recognize and explain basic problems. • Identify possible solutions and their course of action. • Try a solution.	A. Explain and apply scientific and technological knowledge. • Distinguish between a scientific theory and a belief. • Answer "What if" questions based on observation, inference or prior knowledge or experience. • Explain how skepticism about an accepted scientific explanation led to a new understanding. • Explain how new information may change existing theories and practice. B. Apply process knowledge to make and interpret observations. • Measure materials using a variety of scales. • Describe relationships by making inferences and predictions. • Communicate, use space/time relationships, define operationally, raise questions, formulate hypotheses, test and experiment. • Design controlled experiments, recognize variables, and manipulate variables. • Interpret data, formulate models, design models, and produce solutions. C. Identify and use the elements of scientific inquiry to solve problems. • Generate questions about objects, organisms and/or events that can be answered through scientific investigations.	A. Apply knowledge and understanding about the nature of scientific and technological knowledge. • Compare and contrast scientific theories and beliefs. • Know that science uses both direct and indirect observation means to study the world and the universe. • Integrate new information into existing theories and explain implied results. B. Apply process knowledge and organize scientific and technological phenomena in varied ways. • Describe materials using precise quantitative and qualitative skills based on observations. • Develop appropriate scientific experiments: raising questions, formulating hypotheses, testing, controlled experiments, recognizing variables, manipulating variables, interpreting data, and producing solutions. • Use process skills to make inferences and predictions using collected information and to communicate, using space/time relationships, defining operationally. C. Apply the elements of scientific inquiry to solve problems.	A. Evaluate the nature of scientific and technological knowledge. • Know and use the ongoing scientific processes to continually improve and better understand how things work. • Critically evaluate the status of existing theories (e.g., germ theory of disease, wave theory of light, classification of subatomic particles, theory of evolution, epidemiology of aids). B. Evaluate experimental information for appropriateness and adherence to relevant science processes. • Evaluate experimental data correctly within experimental limits. • Judge that conclusions are consistent and logical with experimental conditions. • Interpret results of experimental research to predict new information or improve a solution. C. Apply the elements of scientific inquiry to solve multi-step problems. • Generate questions about objects, organisms and/or events that can be answered through scientific investigations. • Evaluate the appropriateness of questions. • Design an investigation with adequate control and limited variables to investigate a question.

• Describe the solution, identify its impacts and modify if necessary. • Show the steps taken and the results.	• Evaluate the appropriateness of questions. • Design an investigation with limited variables to investigate a question. • Conduct a two-part experiment. • Judge the significance of experimental information in answering the question. • Communicate appropriate conclusions from the experiment. D. Know and use the technological design process to solve problems. • Define different types of problems. • Define all aspects of the problem, necessary information and questions that must be answered. • Propose the best solution. • Design and propose alternative methods to achieve solutions. • Apply a solution. • Explain the results, present improvements, identify and infer the impacts of the solution.	• Generate questions about objects, organisms and/or events that can be answered through scientific investigations. • Evaluate the appropriateness of questions. • Design an investigation with adequate control and limited variables to investigate a question. • Conduct a multiple step experiment. • Organize experimental information using a variety of analytic methods. • Judge the significance of experimental information in answering the question. • Suggest additional steps that might be done experimentally. D. Identify and apply the technological design process to solve problems. • Examine the problem, rank all necessary information and all questions that must be answered. • Propose and analyze a solution. • Implement the solution. • Evaluate the solution, test, redesign and improve as necessary. • Communicate the process and evaluate and present the impacts of the solution.	• Organize experimental information using analytic and descriptive techniques. • Evaluate the significance of experimental information in answering the question. • Project additional questions from a research study that could be studied. D. Analyze and use the technological design process to solve problems. • Assess all aspects of the problem, prioritize the necessary information and formulate questions that must be answered. • Propose, develop and appraise the best solution and develop alternative solutions. • Implement and assess the solution. • Evaluate and assess the solution, redesign and improve as necessary. • Communicate and assess the process and evaluate and present the impacts of the solution.

TYPES OF ASSESSMENT MEASURES

PSSA STEE assessment employs two types of test items: selected response (SR) and constructed response (CR). Each provides different types of information about STEE achievement.

SR Items

In years past, all items included in large-scale assessment programs, such as Pennsylvania's Testing for Essential Learning and Literacy Skills (TELLS; administered 1984–1991), were SR, named because students choose their answers from among those provided. Such items are an efficient means of assessing a broad range of curriculum.

In PSSA STEE assessments, all SR items have four answer choices, with only one correct response; the student is awarded one point for a correct response.

SR questions can be used to assess a variety of skill levels, from short-term recall of specific facts or terminology to in-depth analysis. The great majority of the STEE assessment SR questions require students to carry out some process to determine their answers rather than simply recalling information from memory. To create items that test students' higher level thinking skills, item writers are trained to use Bloom's Taxonomy. Benjamin Bloom and others developed the following hierarchy of cognitive domains: 1) Knowledge, 2) Comprehension, 3) Application, 4) Analysis, 5) Synthesis, and 6) Evaluation.

A typical knowledge question would require students to choose the correct definition of a word. Comprehension questions go one step beyond simple recall, requiring students to interpret material or translate it to other forms. For example, choosing the best graph to represent a statement. Application questions require students to apply previously learned material to new situations such as asking students to predict the probable effects of a change to an ecosystem. For further illustrations, see "Preparing for the Grade 4 (7 or 10) STEE Assessment" of this document, where Bloom's taxonomy is applied to example items.

CR Tasks

For a number of years, the PSSA has used the term open-ended to apply to any question for which students provide a written solution. However, some would justifiably argue that these questions are not open-ended because the question expects students to converge on a limited range of answers, rather than permit students to provide their own solutions from the multitude possible. With this argument in mind, the STEE assessment uses the phrase constructed response rather than open-ended.

CR tasks are especially useful for measuring students' higher-level thinking skills, where students analyze information and apply their knowledge to new situations. In most of these tasks, students are asked to complete two to three sections of increasing difficulty. The first section often requires a short, detailed answer. The next sections usually require a several-sentence response that may or may not relate to the first section. Students may also be asked to draw and label an answer or complete a diagram. There are no response choices for CR items as with SR items. Students must read the tasks carefully, answer the questions asked, provide clear details that support their answers, and write responses directly on the page on which the task is presented.

Representative examples at each grade level of CR tasks, scoring rubrics, and student responses are provided in the "Preparing for the Grade 4 (7 or 10) STEE Assessment" portions of this document. Since a STEE assessment has not been administered in the past, these examples are provided by another state with a similar assessment program; however, they are similar to items on the 2004 STEE Assessment. Further, the representative items have been aligned to the Pennsylvania Standards. As

Pennsylvania items are released and the assessment handbook is updated, these materials will be replaced with released items from Pennsylvania.

SCORING CR TASKS

STEE assessment CR tasks are scored in terms of a continuum of correctness. This continuum is defined by a rubric, which outlines what the general requirements are at each scale point. Scoring guidelines based on the general rubric are developed to score individual tasks. The rubric approach to scoring has made it possible to include CR tasks in large-scale assessments such as the PSSA. Persons who have received training in applying the rubric can reliably and efficiently score large numbers of student responses.

STEE assessment CR tasks vary in type and complexity, yet all are currently scored on a 0 to 4 scale and are currently worth 4 points. Consequently, one four-point CR task is equivalent to four one-point SR items. In an attempt to communicate the overall approach to the scoring process, the Generic Rubric for Scoring STEE CR Tasks (Figure 2) was developed. Although the Generic Rubric outlines the five scoring categories for all tasks, a specific rubric that describes, in detail, what is expected for each score (0–4) must be developed for each item. All scoring rubrics employ the same five scoring categories. What differs is the specific content and knowledge that is required of students. It should be emphasized that, although scoring rubrics differ across items, the same overall philosophy prevails in determining student scores. To receive the highest score for a CR item, students must write clear, complete answers that communicate a strong understanding of each item. Students who have not been asked to write clear explanations to CR questions as part of their STEE classes will find it difficult to attempt it for the first time when responding to the STEE assessment. **It is strongly recommended that, in preparing students for the STEE assessment, teachers include CR questions and strategies to give students practice *determining* what is expected in each response and *writing* thorough explanations of STEE concepts.** Resources and Web sites for developing practice items begin on page 20 of this document.

Figure 2
Generic Rubric for Scoring STEE CR Tasks

Score	General Scoring Criteria
4	The response is clear, complete, answers all parts of the item correctly, and demonstrates a strong understanding of the STEE that is the primary emphasis of the item. All portions are explained and/or described completely, with no content errors, misstatements of fact, or misconceptions.
3	The response is essentially complete, answers most of the item correctly, and demonstrates an understanding of the STEE that is the primary emphasis of the item. The response may contain minor content errors, omissions, misstatements of fact, or misconceptions. The response is basically correct, but lacks clarity, precision, and breadth.
2	The response is incomplete, answers only a portion of the item correctly, and demonstrates only a partial understanding of the STEE that is the primary emphasis of the item. The response may contain omissions, errors, misstatements of fact, and misconceptions, or tend toward simplistic lists lacking necessary descriptions and/or explanations.
1	The response is minimal and demonstrates little understanding of the STEE relevant to the item, but does include some correct information relevant to the item. The response may contain major omissions, errors, misstatements of fact, and misconceptions.
0	The response is incorrect and contains no correct relevant information.
Off Task	The response is irrelevant.
Blank	No response is provided. The answer sheet is blank.

SCORING RUBRICS VERSUS PERFORMANCE STANDARDS

The procedures that were used to establish the State's four performance level descriptors (page 16) should not be confused with the categories being used for scoring individual CR tasks. It is best to think of the scoring rubric as a device for sorting students' work into a number of categories. The work of highest quality is given a score of four. By awarding such a score there is no intent to imply that the student's work should be classified as advanced overall, but rather, that the work accomplished on a particular task was at a high level. In fact, the task could be one that is not particularly demanding, and because of this, a relatively high proportion of students could have received the highest score.

Rubrics in Education

by
Douglas E. Bryant, West York Area School District

Rubrics provide educators with a tool to evaluate, using an objective set of criteria, student work that would otherwise be evaluated subjectively. Although a rubric does not remove all subjectivity from the evaluation, it limits the influence of subjectivity by identifying specific criteria and articulating levels of performance for those criteria.

Benefits of Rubrics

Rubrics provide several benefits. Among these are:

- Providing a clear "target" for students. Students know the criteria upon which they will be evaluated. They also know the expectations for each level of performance.
- Eliminating much student confusion regarding a grade. Students do not need to ask, "Why did I receive a (x grade)?" A well-written rubric should make it clear to the student the area(s) where s/he was proficient and area(s) needing improvement.

Parts of a Rubric

Rubrics are most often constructed on a grid. The left-most column of the grid is used to identify the criteria upon which the work will be evaluated. The top row of the grid is used to identify the levels of performance for the work, expressed either numerically (1, 2, 3, 4) or with terms (e.g., poor, satisfactory, good, excellent). Rubrics should contain an even number of levels of performance, although some numeric rubrics contain a "0" level for work which is too inferior to merit any credit for a particular criteria. (Such work is known as being "off the rubric.")

The third—and most important—part of the rubric is the descriptor. This is a sentence or sentences that are located in a grid square and specify the minimum level of achievement needed to reach that level of performance. For example, let us assume that a rubric has numeric levels of performance from 1 to 4. It also has among its criteria, "Use of Sources." A descriptor for "1" in this criterion might read: "Student demonstrated the use of either one or two outside sources in completing the project." The descriptor for a "2" might read: "Student demonstrated the use of either three or four outside sources in completing the project." And so on.

Using a Rubric

Using a rubric is straightforward. The evaluator looks at the criteria, reads the descriptors for those criteria, and selects the highest level of performance (as described by the descriptor) that the student's work achieves.

ADMINISTERING THE STEE ASSESSMENT

THE ASSESSMENT DESIGN

The 2004 STEE Assessment will consist of four testing sessions. Each testing session will take approximately 30 to 60 minutes depending on grade level; the grade 10 test is significantly larger and more detailed than the elementary assessment. One session will consist of SR items and one or two CR items using the matrix sampling approach. In the other three sessions, SR items and up to two CR items will be administered. These three sessions make up the common portion of the assessment, with all students responding to the same items.

Student scores will be based on this common section. For the matrix session, students will respond to one of ten unique forms. Having matrix forms increases the number of items per standard category, making it possible to produce reliable results for more categories. School scores will be based on all items from both the common and matrix forms. The design for the 2004 STEEAC Assessment is outlined below (Figure 3).

Figure 3

STEE Assessment Design			
	Test Layout		
Grade Level	4	7	10
Section 1	1 CR/24 SR-Common	1 CR/30 SR-Common	1 CR/30 SR-Common
Section 2	1 CR/18 SR-Matrix 1 CR Field Test-Matrix or 15 SR Field Test-Matrix	1 CR/24 SR-Matrix 1 CR Field Test-Matrix or 15 SR Field Test-Matrix	1 CR/31 SR-Matrix 1 CR Field Test-Matrix or 15 SR Field Test-Matrix
Section 3	28 SR-Common	1 CR/20 SR-Common	2 CR/30 SR-Common
Section 4	28 SR-Common	1 CR/20 SR-Common	1 CR/45 SR-Common
Form Item Requirements	2 CR/98 SR/ 1 FCR/15 FSR	4 CR/94 SR/ 1 FCR/15 FSR	6 CR/136 SR/ 1 FCR/15 FSR
Total Item Requirements	11 CR/260 SR/ 10 FCR/150 FSR	13 CR/310 SR/ 10 FCR/150 FSR	15 CR/415 SR/ 10 FCR/150 FSR
	Test Duration (min.)		
Section 1	50	50	60
Section 2	60	60	60
Section 3	30	40	60
Section 4	30	40	60
Total Test Duration (min)	170	190	240
	Point Distributions		
Total Test Points	106	110	160
Items Generating Student Scores	1 CR/56 SR	3 CR/70 SR	5 CR/105 SR
Items Generating School Scores	11 CR/260 SR	13 CR/310 SR	15 CR/415 SR

CR (constructed response) questions = open-ended
SR (selected response) questions = multiple choice

FCR = field test constructed response
FSR = field test selected response

USE OF EQUIPMENT

Students are not permitted to use textbooks, dictionaries, or reference material of any kind when they are responding to test items. If such materials were allowed, students could use them, for example, to provide a correct answer to certain questions by looking up a definition and then applying it to a question. In addition, students may not use materials such as rulers, beakers, or scales that could give them an unfair advantage over students who do not have such material available during testing. Some items may require the use of simple manipulatives, which will be provided to all students and included with the assessment. Currently, items that require complex mathematical solutions are not included in the assessment. Therefore, calculators are not permitted. Some items may require the use of simple arithmetic that can be easily completed without the use of a calculator.

A black, No. 2 pencil must be used for the answer booklet. Students may, however, use colored pencils, hi-liters, or similar items for highlighting questions and/or answer choices. These may make it easier for some students to focus their attention during testing and do not provide them with an unfair advantage.

PERMITTED HELP DURING THE ASSESSMENT

Posters and charts displaying specific STEE-related information should not be displayed during testing. As an example, water cycle diagrams should be covered if they are on the walls of a testing room. In general, anything that might assist students in answering specific questions should not appear in the testing situation. On the other hand, materials that are **general** in nature (e.g., a poster of a forest) are permitted.

When administering the assessment, **no help** should be given to students. This means that students should **not** be told the meaning of words they do not understand. Teachers may **pronounce** words properly for students. Further, it is acceptable **before the assessment** to remind the students that they should read each question carefully and, concerning CR items, write clear, complete answers to all parts of the item. **Once the assessment has begun**, however, the test administrator should **not** make any more statements about this to the entire group or to individual students.

THE FOCUS OF THE STEE ASSESSMENT

PLANNED INSTRUCTION

The purposed of STEE assessment is to provide students, school districts (including charter schools), AVTSs, and communities with information concerning student achievement on the Academic Standards. This information should be used to design planned instruction to enable the students to achieve the Academic Standards.

REPORTING SCHOOL AND STUDENT SCORES

Beginning with the 2004 STEE Assessment, the major focus in reporting STEE assessment scores will be on how well schools and individual students perform on selected standard categories. The STEE standards contain the 17 different standard categories listed on pages 6 and 7 of this document. A report with reliable results for all of these academic areas would require an assessment significantly longer than other statewide assessments. Therefore, a modified reporting system will be used.

At present, STEE results will be reported at both the student and school levels. Students will receive a scaled STEE score based on the overall results of their test. They will also receive raw scores that show how well they performed on each of the different reporting categories of their test. Recall that there are 17 standard categories that cover STEE. These range from Unifying Themes (3.1) of Science and Technology to Environmental Laws and Regulations (4.9).

To create valid scores for individual standard categories, it is necessary to ask a variety of questions that assess each category. To generate valid scores for individual students in all 17 standard categories, the assessment would be too long. Therefore, the STEE assessment will not generate individual student scores for all STEE categories. The student score report will be generated from the section of the assessment that is common to all students throughout the state. In short, all students will be scored on the same common questions.

It is possible to generate valid scores more easily at the school level by increasing the number of questions presented for each standard category. A matrix is created to increase these numbers. All schools at the same grade level will get the same questions, but students taking different versions of the exam will not. School level scores will be reported as scaled STEE scores. Schools will also receive scaled scores that are based on the standard categories and on some specific standard statements. School scores will be generated from results of the common and the matrix portions of the STEE assessment. Please note that for reporting purposes, it is necessary to link certain categories together. The general reporting categories are: General Science and Technology Concepts, Biological Sciences, Physical Sciences, Earth Sciences, Technology Education, Technological Devices, Human Environmental Interactions.

DEVELOPING GENERAL PERFORMANCE LEVEL DESCRIPTORS

In accordance with the requirements of Chapter 4.51 relating to the implementation of PSSA and Act 16 of 2000 (Senate Bill 652) relating to Education Empowerment, the Pennsylvania Department of Education is developing a STEE assessment. As part of this assessment, the department will develop specific performance level descriptors for STEE consistent with State Board of Education regulations, which state: “Levels of proficiencies shall be Advanced, Proficient, Basic and Below Basic.”

As a first step in carrying out the State Board’s instructions, the Department of Education developed general performance level descriptors. These are statements defining the levels of achievement required at each of the four performance levels regardless of the content area being addressed. The initial set of descriptors was sent for review to approximately 1,700 people including educators, students, parents, and citizens. Revisions were made on the basis of recommendations of the survey participants, and the descriptors were finalized. The general performance level descriptors for Pennsylvania are listed below.

Advanced The Advanced Level reflects superior academic performance. Advanced work indicates an in-depth understanding and exemplary display of the skills included in the Pennsylvania Academic Content Standards.

Proficient The Proficient Level reflects satisfactory academic performance. Proficient work indicates a solid understanding and display of the skills included in the Pennsylvania Academic Content Standards.

Basic The Basic Level reflects marginal academic performance. Basic work indicates a partial understanding and display of the skills included in the Pennsylvania Academic Content Standards. This work is approaching acceptable performance but has not reached it.

Below Basic The Below Basic Level reflects inadequate academic performance. Below Basic work indicates little understanding and minimal display of the skills included in the Pennsylvania Academic Content Standards. There is a major need for additional instructional opportunities and/or increased student academic commitment to achieve the Proficient Level.

Since the State Board directed that specific criteria for the four levels be developed, the next step will require the determination of what STEE test scores will define each of the four levels. STEE assessment total scores for students are scaled scores. Consequently, there will be a need to determine which scaled scores in STEE assessment are required for student work to be classified as advanced, proficient, and basic levels. All scores that fall below the basic level would be defined as below basic. Two to three years of STEE assessment scores will be needed to implement this process, so STEE general performance level score ranges most likely will not be adopted by the State Board until there is sufficient data.

GENERAL PREPARATION SUGGESTIONS FOR THE STEE ASSESSMENT

ADVICE FOR TEACHERS IN PREPARING STUDENTS FOR THE ASSESSMENT

1. Become familiar with the Pennsylvania Academic Standards and align your curriculum to address them. STEE assessment reflects the STEE standards. Preparation for the test cannot occur in a day or two but must be an ongoing developmental process beginning at the primary levels.

2. Ensure that your students understand what is expected by the words **identify**, **describe**, and **explain** in CR items. In scoring CR items, less weight is typically given to tasks that only ask for identifications as compared to those that ask for explanations.

3. Communicate with teachers in different grade levels. Encourage teachers to develop and use CR items with rubrics.

4. Collaborate with other teachers at your grade level. The STEE Standards require education outside of areas that are traditionally taught in science classes.

5. Model CR item responses for your students, including the organization of the rubric. Specific examples have been provided in this manual.

6. Teach students what is expected of them in a CR item. Write example CR items for and with your students as modeling activities. Guide them in developing a rubric. Examine how a question can be scored using a 0–4-point scale. It will provide students with insight as to what is expected in the response.

7. Teach students that they can usually earn at least one point by writing one correct response. However, to earn all the possible points, they will need to not only know the correct answers, but also be able to write a response that clearly and completely responds to all the tasks presented.

8. Provide time for students to practice writing answers to CR items individually before sharing in small groups and discussing as a class. The sample questions in this manual are an excellent starting point.

9. Stress the requirements for CR responses and review the sample responses in the manual with your students.

10. Stress the importance of reading carefully and answering the specific question asked.

11. Insist that students use scientific and technical terms in their explanations.

12. Be sure to read the handbook appendix, "Testing Accommodations to Encourage Participation by Students with Disabilities in the Pennsylvania System of Assessment."

13. Encourage all students to take this test seriously. Moreover, remember that your attitude toward the test overtly and covertly communicates itself to your students.

14. Please use these suggestions to include **all** students. Remember that these strategies also apply to those students to the extent of their IEPs.

One District's Journey in Curriculum Alignment

by

Charles English, Altoona Area School District

"Science must be taught well, if a student is to understand the coming decades he must live through."
– Isaac Asimov

Embracing Asimov's statement, the Altoona Area School District has worked to keep scientific studies a priority in education. Reading, math, and writing have been the **instructional** focal point of the District. In the District's ten elementary schools, science has been squeezed into the curriculum whenever and wherever it could fit into the school day. In the District's secondary schools, science teachers have been the only ones who have attended to the issues of this discipline. The state's adoption of the new educational standards in science, technology, environment, and ecology (STEE) has opened new concerns, ideas and priorities in an educational system that was already feeling too full. This led to the creation of in-services on how to address the new standards and how these standards will impact education from kindergarten through the twelfth grade.

Secondary and elementary teachers had to take a new look at how much they were meeting the STEE Standards. Each had a different concern in how they were going to meet the new standards.

Secondary education has science classes as part of the daily schedule for the students; however, teachers were concerned about how much of the material they are currently covering fits the standards. The teachers were also concerned about the preparation of the students coming from the elementary schools. First the teachers worked to align their current curriculum to the standards. Needing to focus their attention on one subject at a time, the teachers sought out additional material and curriculum that could be included in their existing routine to enhance the students' understanding of environment and ecology. Over the next year or two the secondary level schools are reorganizing their class options for the students so that the classes they offer will be better aligned with the standards. Several of the science educators, in cooperation with the curriculum director, then took a look at the elementary schools to see what needed improvement in the science program at this level, in order to better prepare the students.

The Altoona Area School District moved its elementary science program to hands-on science over ten years ago. The rationale was good. The lessons were fun, but they did not reflect the goals written into the standards packets now being disseminated throughout the state. The budget will not allow for a purchase of new science textbooks within the next few years. The District is also concerned that it would be difficult to evaluate the effectiveness of the texts in preparing students for these new standards. It would take several years before any solid statistics would point to one text as more effective than another.

The elementary teachers have been brought together by grade level to review currently used curriculum specifically in the area of environment and ecology. Together with curriculum directors and coordinators, the teachers aligned existing curriculum to the standards. The teachers created a master list, which showed the holes in the curriculum where content was either not taught effectively or at all. The administrative team then knew where to focus attention and finances. Curriculum that did not fit effectively into a standard is being dropped. The curriculum is being thinned out to be as efficient as possible. This is helping teachers to see that the standards were not necessarily a burden, but help give focus to the subjects and issues that the department of education felt necessary to promote in public education.

Next is a need to create some new additional curriculum for the elementary level. This is being done by looking for matches in other academic areas, such as reading and writing, social studies, history and math. Since the school district recently adopted a new reading and writing curriculum, new matches are sought out there first, interweaving the curriculum. This would save time and energy in the long run for the teacher as well as blend disciplines for the students. When no further matches could be made in the curriculum an education coordinator took on the role of finding materials that would help support the remaining gaps so that the standards were covered.

The ideas are in place, and the teachers are working to implement the new curriculum. Within the next few years, we shall learn how effectively we have utilized the standards in refocusing the curriculum to meet goals established for students.

RESOURCES AND WEB SITES FOR DEVELOPING PRACTICE ITEMS

Local/district curriculum people (i.e., specialists in science, technology, environment, or ecology)

Your textbooks and supplements. Most publishers have included CR problems in their latest publications or they can be purchased separately.

Pennsylvania's curriculum advisors for STEE.

Web site for Pennsylvania Department of Education: **www.pde.state.pa.us**

Web site for Pennsylvania's professional STEE associations:

- Science Teachers' Association: **www.pascience.org**
- Technology Education Association of Pennsylvania: **www.teap-online.org**
- Pennsylvania Alliance for Environmental Education: **www.paee.org**
- Pennsylvania Association of Agricultural Educators: **www.paae.org**

The National Science Teachers Association has a great web site at **www.nsta.org.** There you will find information to assist you in developing practice questions as well as current information on all aspects of science teaching. You can also subscribe to NSTA's science education publications: *The Science Teacher* for high school science, *Science Scope* for middle school science, and *Science and Children* for elementary science.

Web site for Project 2061: **www.project2061.org**

www.aaas.org The Web site for the American Association for the Advancement of Science. This organization developed Project 2061.

www.sciencenetlinks.com An excellent site sponsored by the American Association for the Advancement of Science (AAAS). It contains links to the Benchmarks for Science Literacy (the K–12 science standards outlined by AAAS's Project 2061), Internet resources that support the standards and lessons, K–12, that are aligned with the Benchmarks.

International Technology Education Association: **www.iteawww.org**

The National Assessment of Educational Progress Web site is a great site for testing information and actual sample science items: **www.nces.ed.gov/nationsreportcard**

Released items from Kentucky's state science assessment can be found at **www.kde.state.ky.us.** Try searching using "science released items."

Released items from Louisiana's state science assessment can be found at **www.doe.state.la.us.** Click on "The Tests" and then LEAP 21 to find released items.

Other states with example test items. Search their sites using combinations of these words, science, released items, science assessment, test items, etc.

- Colorado: **www.cde.state.co.us**
- Missouri: **www.dese.state.mo.us**
- Texas: **www.tea.state.tx.us**

The Third International Mathematics and Science Study (TIMSS) is a worldwide study of mathematics and science achievement. At **timss.bc.edu** you will find released test items if you search under "items."

The American Educational Research Association's Web site, **www.aera.net**, has articles about testing.

Benjamin Bloom et al., *Taxonomy of Educational Objectives: The Classification of Educational Goals*, Longmans, Green and Co., New York, 1956, Vol.1.

RESOURCES AND WEB SITES FOR DEVELOPING RUBRICS

rubistar.4teachers.org This site provides an easy-to-use template for creating rubrics.

teachers.teach-nology.com/web_tools/rubrics/general Another site for creating rubrics using a template.

www.bestteachersites.com/web_tools/rubrics/general This resource focuses on rubrics for elementary and secondary inquiry lessons.

www.intranet.cps.k12.il.us/Assessments/Ideas_and_Rubrics/ideas_and_rubrics.html This is the part of the Chicago Public Schools Web site. It contains background information concerning the importance of rubrics, how to evaluate and create a rubric as well as example rubrics.

www.middleweb.com/rubricsHG.html This Web page provides a very good overview of rubrics. In particular it discusses the usefulness and creation of rubrics.

edweb.sdsu.edu/webquest/rubrics/weblessons.htm This site presents a very effective article on creating rubrics.

www.asd.wednet.edu/EagleCreek/Barnard/sites/ed/rubric.htm This site contains 35 links to Web sites relating to rubrics.

www.pals.sri.com has example test items and rubrics, as well as links to other sites.

PREPARING FOR THE GRADE 4 STEE ASSESSMENT

INTRODUCTION

The STEE Assessment for grade 4 encompasses concepts up to and including grade 4. This assessment is a measurement of the complete elementary program and is not to be considered or evaluated solely as a fourth-grade test.

REPORTING CATEGORIES

More test items will be placed on the grade 4 assessment for some standard categories than for others. The categories for which more items will be included are those that are most reflective of the curriculum at the grade 4 level and below. For reporting purposes, the Standard Categories have been grouped together.

Standards Categories	Reporting Categories
3.1, 3.2, & 3.8	General Science and Technology Concepts
3.3, 4.6, & 4.7	Biological Sciences
3.4	Physical Science, Chemistry, and Physics
3.5 & 4.1	Earth Sciences
3.6	Technology Education
3.7	Technological Devices
4.2, 4.3, 4.4, 4.5, 4.8, & 4.9	Human Environmental Interactions

Students must have an understanding of the concepts and terms included in the Standards through grade 4. This understanding should go beyond simple knowledge recall (Bloom's Level One). Students should be able to translate and apply the terms to new situations when answering an item.

GRADE 4 SAMPLE ITEMS, SCORING RUBRIC, AND STUDENT RESPONSES

Grade 4 Selected Response Items with Bloom's

1. An example of a solid turning into a liquid is

   A water freezing into ice.
   B water turning into steam.
   C ice melting into water. *
   D steam turning into water.

Bloom's Level One: Knowledge

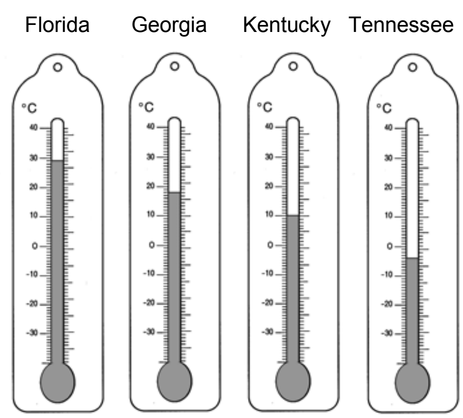
Students must identify the option with a solid and a liquid in the correct sequence.

2. A year is the time it takes

   A Earth to make one complete circle around the sun. *
   B Earth to make one complete spin on its axis.
   C the moon to make one complete circle around Earth.
   D the sun to make one complete spin on its axis.

Bloom's Level One: Knowledge
Students recall the definition of a year.

Use the thermometers below to answer the next question.



3. The thermometers above show temperatures reported by the National Weather Bureau on the same day in four different states. It is snowing in only one of the states. In which state is it snowing?

   A Florida
   B Georgia
   C Kentucky
   D Tennessee *

Bloom's Level Two: Comprehension
Students read the temperature from the thermometer and determine which temperature will allow snow to form.

4. Why do humans need different kinds of food in their meals?

   A Humans get tired of always eating the same things.
   B Humans need different foods to keep healthy. *
   C Eating the same foods is bad for digestion.
   D Finding the same foods is difficult in some areas.

Bloom's Level Two: Comprehension
Students use prior understanding of nutrition to evaluate and choose the appropriate option.

5. When one end of a steel rod is held in a flame, the other end of the rod gets hot. This happens because steel

   A makes the flame hotter.

   B makes its own heat.

   C is a good conductor of heat. *

   D keeps cold away from the flame.

Bloom's Level Two: Comprehension

Students associate the description of heat transfer through the rod to the definition of conduction.

6. Why does it feel cooler to wear light-colored clothes in the summer compared to dark-colored clothes?

   A Light-colored clothes are not as heavy.

   B Light-colored clothes let more air in.

   C Light-colored clothes prevent sweating.

   D Light-colored clothes reflect more sunlight. *

Bloom's Level Two: Comprehension

Students use their prior knowledge that light colors reflect more light than darker colors and then translate that into light-colored clothes feeling cooler.

7. Wild deer live in the Allegheny National Forest. Which would make the deer population smaller?

   A building ponds in some of the forest clearings

   B introducing grey wolves to the area *

   C moving people away from the area

   D planting new trees where old ones were cut

Bloom's Level Three: Application

Students must analyze each option with respect to its effect on the deer population.

8. A rock layer in Pennsylvania contains fossils of seashells. Which is the **best** explanation of how the fossils got there?

   A An earthquake pushed shells up from underground.

   B A flood carried the shells to the area.

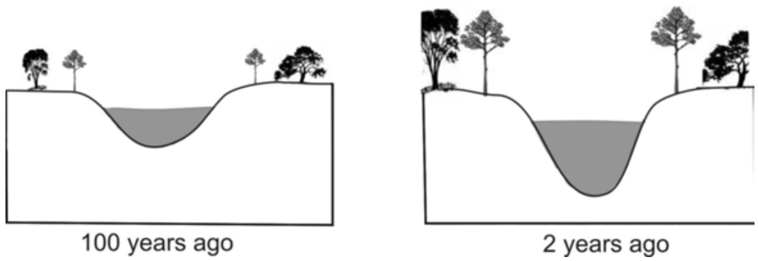
   C A river washed the shells downstream.

   D A sea once covered the area. *

Bloom's Level Two: Comprehension

Students use their knowledge of fossil formation and Earth processes to determine the most reasonable option.

The figures below show a cross section of a river.



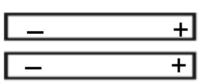
9. The first figure shows how the river looked one hundred years ago. The other shows how the river looked two years ago. Why did the river change?

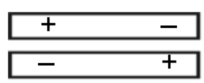
   A A beaver built a dam on the river.
   B An earthquake made the land drop.
   C The river carried the sand and soil away. *
   D A volcano erupted and formed a valley.

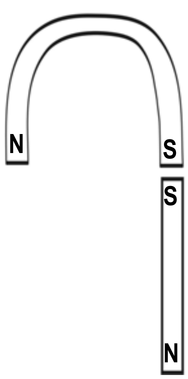
Bloom's Level Two: Comprehension

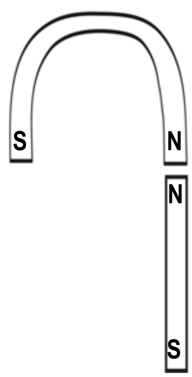
Students evaluate the pictures and apply knowledge of river flow and erosion to determine the correct answer. The options require the students to do a minimal amount of analysis.

10. Magnets are placed side by side as shown below. In which arrangement will the two magnets attract each other?

A 

B  *

C 

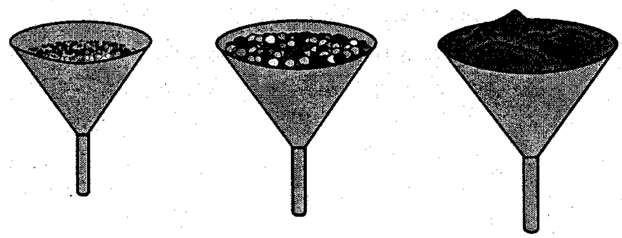
D 

Bloom's Level Two: Comprehension

Students apply their knowledge of magnetism to the diagrams.

Constructed Response Grade 4

Joe's Soil Experiment



Joe is doing an experiment to find out which type of soil soaks up the most water. He starts by getting three funnels and putting a different type of soil into each funnel, as shown in the figures above. Joe then pours water into each funnel until water begins to drip from the bottom. His experiment has some mistakes.

A Describe **two** mistakes in the design of Joe's experiment.

B Describe how Joe could correct the mistakes you described in **Part A**.

Scoring Rubric

Score	Criteria
4	The response is complete and shows a strong understanding of how to design a simple controlled experiment. There are clear, accurate descriptions of two mistakes in the design of the experiment and a description of a plausible way to correct each of the mistakes.
3	The response shows an understanding of how to design a simple controlled experiment. There are descriptions of two mistakes in the design of the experiment and a description of a way to correct at least one mistake. The response may lack detail or contain minor errors or misconceptions.
2	The response shows a limited understanding of how to design a simple controlled experiment. There is a description of a mistake(s) and/or of how to correct a mistake(s); however, the response may reveal misconceptions and/or contain errors or omissions.
1	The response is incomplete and shows a minimal understanding of how to design a simple controlled experiment. There may be an attempt to describe mistakes and/or corrections for the mistakes, but the response contains major errors, misconceptions, and omissions.
0	The response is incorrect or contains no relevant information.
Blank	No response.

Science Behind the Question

In designing an experiment, it is important to control variables that could affect the outcomes. In this experiment, it would be important to have the same type and size of funnel, to use the same amount of each soil, and to pour the same amount of water into each funnel. A possible error is in providing a plug of material to prevent soil from washing from the funnel. Joe needs containers to collect the water, such as beakers or graduated cylinders. He also needs a method for measuring how much water was absorbed and how much passed through, such as measuring how much water collects in a container under the funnel.

Student Responses

Score of 4

Student Response

Two mistakes Joe made are he did not put the same amount of sand, potting soil, or clay into the funnel. He could correct that mistake by measuring the soil.

Another mistake is he may not have used the same amount of water either. So he could correct that mistake by using a measuring cup to measure out the same amount of water in each funnel.

Those are two mistakes Joe made.

Student accurately describes one mistake in the design of Joe's experiment (i.e., Joe did not put the same amount of soil in each funnel) and describes how the mistake could be corrected.

Student accurately describes a second mistake in the design of Joe's experiment (i.e., Joe did not put the same amount of water in each funnel) and describes how the mistake could be corrected

Overall, the student shows a strong understanding of how to design a simple controlled experiment. The student both accurately describes two mistakes in the design of the experiment and accurately describes how each mistake could be corrected.

Score of 3

Student Response

I am going to describe two of the mistakes in the design of Joe's experiment. Joe for got the cups to put under the funnles. And put two much clay.

He could put the cups under the funnels and He could take some clay out.

I just told you how Joe made mistakes on.

Student generally describes two mistakes in the design of Joe's experiment (i.e., Joe did not put cups under the funnels and he "put two much clay"). Response lacks detail (e.g., the purpose of the cups) and the second mistake only addresses part of the soil amount problem (i.e., none of the three funnels contained the same amount of soil).

Student generally describes how each problem could be corrected (i.e., Joe "could put cups under the funnels" and he "could take some clay out"). Again, the second correction only addresses part of the soil problem.

Overall, the student shows a general understanding of how to design a simple controlled experiment. The student generally describes two mistakes in the design of the experiment and generally describes how each of the mistakes could be corrected. One of the described mistakes and its correction is somewhat incomplete.

Score of 2

Student Response

a. I will Describe 2 of the mistakes design of Joe's experiment.

There Diffent sizes funls.

Clay is not a potting soil.

b. I will Describe how Joe could correct the mistakes.

If they got the sam size funls it would be better.

if they got dirt it would be better.

Student accurately describes one mistake in the design of Joe's experiment (i.e., Joe used different sizes of funnels). Student attempts to describe a second mistake (i.e., "clay is not a potting soil"), but the description does not reflect a mistake in the design of the experiment.

Student accurately describes how Joe could correct the funnel mistake (i.e., Joe could use funnels of the same size) and attempts to describe how to correct the soil mistake.

Overall, the student shows some understanding of how to design a simple controlled experiment. The student accurately describes one mistake in the design of the experiment and accurately describes how to correct that mistake.

Score of 1

Student Response

A) (1) The clay in one funnel will soak up the water but start to leak out the bottem, the clay will probably get on him and will not come out of his clothes.

(2) The sand will not soak up water it will run out of the bottem. Joe needed to get funnels without wholes in the bottom.

B) (1) Joe could just use the 2 other soils.

(2) Joe could buy some funnels that did not have any holes in them or get a bucket for each one.

Student attempts to describe two mistakes Joe made in the design of his experiment, but neither mistake is correct.

Student accurately states that Joe could put a bucket under each funnel.

Overall, the student shows a minimal understanding of how to design a simple controlled experiment by accurately stating that a bucket could be put under each funnel used in the experiment.

PREPARING FOR THE GRADE 7 STEE ASSESSMENT

INTRODUCTION

The STEE Assessment for grade 7 encompasses concepts up to and including grade 7. This assessment is a measurement of the complete program to grade 7 and is not to be considered or evaluated as solely a seventh-grade test.

REPORTING CATEGORIES

More test items will be placed on the grade 7 assessment for some standards categories than for others. The categories for which more items will be included are those that are most reflective of the curriculum at the grade 7 level and below. For reporting purposes, the Standard Categories have been grouped together.

Standards Categories	**Reporting Categories**
3.1, 3.2, & 3.8	General Science and Technology Concepts
3.3, 4.6, & 4.7	Biological Sciences
3.4	Physical Science, Chemistry, and Physics
3.5 & 4.1	Earth Sciences
3.6	Technology Education
3.7	Technological Devices
4.2, 4.3, 4.4, 4.5, 4.8, & 4.9	Human Environmental Interactions

Students must have an understanding of the concepts and terms included in the Standards through grade 7. This understanding should go beyond simple knowledge recall (Bloom's Level One). Students should be able to translate and apply the terms to new situations when answering an item.

GRADE 7 SAMPLE ITEMS, SCORING RUBRIC, AND STUDENT RESPONSES

Grade 7 Selected Response Items with Bloom's

1. Juan thinks that water will evaporate faster in a warm place than in a cool one. He wants to do an experiment to find out if he is correct. He has two identical bowls and a bucket of water. Which should he do?

   A Place a bowl of water in a cool place and a bowl with the same amount of water in a warm place. *

   B Place a bowl of water in a cool place and a bowl with twice the amount of water in a warm place.

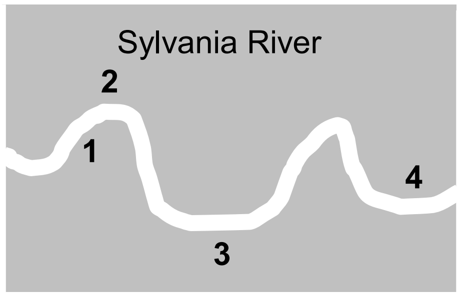
   C Place a bowl of water in a cool place and a bowl with half of the amount of water in a warm place.

   D Place two bowls with the same amount of water in a warm place.

Bloom's Level Three: Application

Students analyze options to eliminate those that violate the principle of scientific testing where only one variable is tested at a time and judge whether or not an option is logical.

Use the figure below to answer the next question.



2. Sylvania River flows through flat land and is the same depth at each point. At which point is the river current fastest?

   A 1
   B 2 *
   C 3
   D 4

Bloom's Level Three: Application

Students must analyze the conditions given in the item and apply their knowledge of stream flow velocity to the four locations.

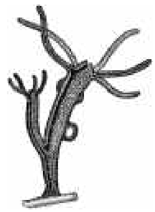
3. Messages are carried from the eyes to the brain by

   A blood vessels.
   B light.
   C muscles.
   D nerves. *

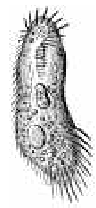
Bloom's Level One: Knowledge

Students recall definitions to match the description to an option.

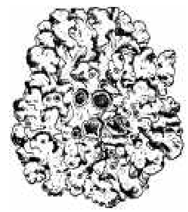
Use the figures below to answer the next question.



Hydra



Paramecium



lichen

moss

4. Which is an example of a single-celled organism?

   A *Hydra*
   B *Paramecium* *
   C lichen
   D moss

Bloom's Level One: Knowledge

Figures are included to help students recall which is the single-celled organism.

5. Hannah notices that a living organism changes color when exposed to a lower temperature. Hannah is making

   A a conclusion.
   B a hypothesis.
   C an inference.
   D an observation. *

Bloom's Level Two: Comprehension

Students are presented with a situation and must apply prior knowledge to determine the correct option. More than a simple definition is required.

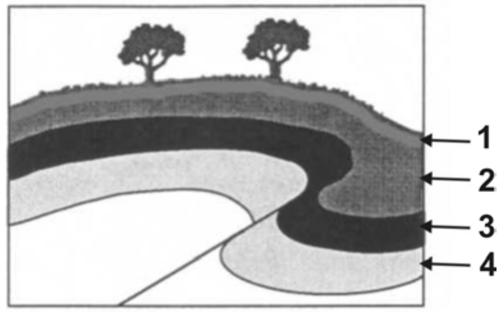
6. Which substance, when mixed with water, can be separated from the water using a paper filter?

   A oxygen
   B salt
   C sand *
   D sugar

Bloom's Level Two: Comprehension

Students must use prior knowledge of the properties of the substances in the options to analyze each option's/substance's ability to be separated with a paper filter after being mixed with water.

Use the figure below to answer the next question.

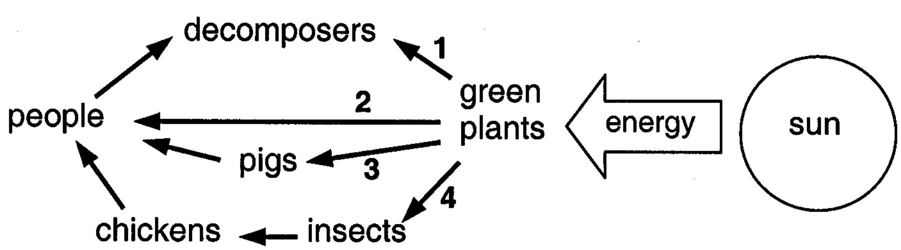


7. In the diagram above, which sedimentary rock layer is probably the oldest?

   A layer 1
   B layer 2
   C layer 3
   D layer 4 *

Bloom's Level Two: Comprehension
Students interpret the diagram using their knowledge of geologic principles and processes.

Use the figure below to answer the next question.



8. In ecosystems, the sun's energy is transferred through food webs similar to the one shown above. The sun's energy is **most** directly available to people through

   A path 1.
   B path 2. *
   C path 3.
   D path 4.

Bloom's Level Two: Comprehension
Students must evaluate the possible paths that the sun's energy flows and determine which path is the "most direct." The item is neither complicated enough nor novel enough to warrant classifying it as a level three item.

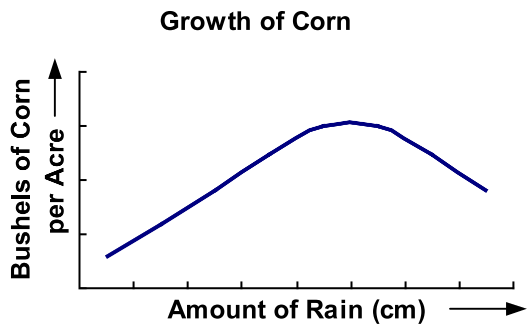
9. A microfossil is viewed under a microscope's high power objective. If the magnification of the eyepiece is 10X and the magnification of the high power objective is 40X, how many times larger does the microfossil appear?

A 4
B 40
C 400 *
D 4000

Bloom's Level Two: Comprehension

Students use prior knowledge of microscopes to make a relatively simple calculation.

Use the graph below to answer the next question.



10. Which is the **best** conclusion you can make using the information from the graph shown above?

A Corn can grow well even if there is no rain.
B Corn needs rain to grow, but too much rain is harmful. *
C Different kinds of corn need different amounts of rain to grow best.
D The more rain there is, the better the corn will grow.

Bloom's Level Three: Application

Students must not only analyze the graph, but also evaluate the options in order to judge which is the best.

Constructed Response Grade 7

Reducing Energy Use
Electrical energy is used in buildings such as schools to provide electricity for machines, equipment, and heating and cooling units. A Identify two changes in a school's design that could be made to keep the use of electrical energy low. B Identify two ways students and teachers in a school could help keep electrical energy usage low.

Scoring Rubric

SCORE	CRITERIA
4	The response is complete and shows a solid understanding of factors that affect energy transfer, consumption, and conservation. Two appropriate school design changes and two specific ways that students and teachers could help keep electrical energy usage low are clearly identified.
3	The response shows understanding of factors that affect energy transfer, consumption, and conservation. Response may contain minor errors or omissions. Two appropriate school design changes and one specific way that students and teachers could help keep electrical energy usage low are identified. **or** One appropriate school design change and two specific ways that students and teachers could help keep electrical energy usage low are identified.
2	The response shows a limited understanding of factors that affect energy transfer, consumption, and conservation. The response may lack some relevance and contain errors, misconceptions, or omissions. One school design change and one way that students and teachers could help keep electrical energy usage low are identified. **or** Two school design changes are identified (with no ways that students and teachers could help). **or** Two ways that students and teachers could help keep electrical energy usage low are identified (with no school design changes).
1	The response is incomplete and shows a minimal understanding of factors that affect energy transfer, consumption, and conservation. There is an attempt to identify at least one school design change or one way that students and teachers could help keep electrical energy usage low. However, the response contains major errors, misconceptions, and omissions.
0	The response is incorrect and contains no relevant information.
Blank	No response.

Science Behind the Question

Examples of school design changes: reflective/insulating window coverings in summer, insulating window coverings at night in winter, energy-efficient lights, motion sensing lights that turn off when no one is in the room, double- or triple-paned glass, efficient heating/air conditioning systems, efficient insulation, and low-flow water controls for showers and faucets (use less hot water).

Examples of ways that students and teachers could help keep electrical energy usage low: turning off lights, overhead projectors, and other equipment when rooms are not in use; keeping doors closed when air conditioning or heating is in use.

Student Responses

Score of 4

Student Response	Commentary
There are many things at schools that use electricity. Sometimes we do not even think about how much it costs or how much we use it. We never think about how we can reduce the use of electricity, but we should.	
Schools could be designed with less lights which will save electricity. Schools could also install more windows that can be opened so the schools will not have to turn on the air conditioning as much in warm weather.	Student identifies two appropriate school design changes that would reduce electrical energy use (i.e., having less lights and adding more windows that open).
The students and teachers could also help by doing simple things like turning off the lights when they leave the classroom. Also, everyone could bring a jacket to school in case they get cold. Then teachers will not have to turn the heater on all the time.	Student identifies two specific ways that students and teachers could help keep electrical energy usage low (i.e., turning off lights when leaving classrooms and bringing jackets to school).
These are some of the great ways to reduce the use of energy in schools and at home. At my house, we always turn off the lights. Our mom is always happier when she receives the bill.	Overall, the response demonstrates a solid understanding of factors that affect energy transfer, consumption, and conservation.

Score of 3

Student Response

To keep the use of electrical energy low a school could use fewer ceiling lights and a school could buy less equipment that has to be plugged in. This would save a lot of electrical energy, if someone would buy equipment that uses batteries.

Teachers and students could keep electrical energy usage low by turning off computers while they are not being used, and they could turn off classroom lights when they are not in the classroom.

Student identifies one appropriate school design change (i.e., using fewer ceiling lights). Student attempts to give a second school change; however, replacing "plugged in" equipment with battery-operated equipment does not represent a school design change.

Student clearly identifies two specific ways that teachers could help keep electrical energy usage low (i.e., turning off computers when not in use and turning off lights when not in the classroom).

Overall, the student demonstrates an understanding of factors that affect energy transfer, consumption, and conservation.

Score of 2

Student Response

One change to a school that would lessen the electrical bill would be to add insulation to the school. An extra layer of insulation would keep in heat or cool. It would cut down on heating and cooling bills.

Classrooms could turn off their lights when they leave. This would cut the electrical bill dramatically. By conserving our energy we can become much more cost efficient.

Student identifies an appropriate school design change that would reduce electrical energy use (i.e., adding insulation).

Student identifies one way that students and teachers could help keep electrical energy usage low (i.e., turning off lights when leaving classrooms).

Overall, the response demonstrates a limited understanding of factors that affect energy transfer, consumption, and conservation.

Score of 1

Student Response

The school could not use so many things just what they need.

The students and teachers could keep the electricity low if they just used something only when needed. Like if the students are hot, they can open a window instead of turning on the air conditioner.

Student attempts to identify a school design change, but it is too vague to receive credit.

Student identifies one way that teachers and students could help keep electrical energy usage low (i.e., opening windows rather than using the air conditioner).

Overall, the student demonstrates minimal understanding of factors that affect energy transfer, consumption, and conservation.

PREPARING FOR THE GRADE 10 STEE ASSESSMENT

INTRODUCTION

The STEE Assessment for grade 10 encompasses concepts up to and including grade 10. This assessment is a measurement of the complete program to grade 10 and is not to be considered or evaluated as solely a tenth-grade test.

REPORTING CATEGORIES

More test items will be placed on the grade 10 assessment for some standards categories than for others. The categories for which more items will be included are those that are most reflective of the curriculum at the grade 10 level and below. For reporting purposes, the Standards Categories have been grouped together.

Standards Categories	**Reporting Categories**
3.1, 3.2, & 3.8	General Science and Technology Concepts
3.3, 4.6, & 4.7	Biological Sciences
3.4	Physical Science, Chemistry, and Physics
3.5 & 4.1	Earth Sciences
3.6	Technology Education
3.7	Technological Devices
4.2, 4.3, 4.4, 4.5, 4.8, & 4.9	Human Environmental Interactions

Students must have an understanding of the concepts and terms included in the Standards through grade 10. This understanding should go beyond simple knowledge recall (Bloom's Level One). They should be able to translate and apply the terms to new situations when answering an item.

GRADE 10 SAMPLE ITEMS, SCORING RUBRIC, AND STUDENT RESPONSES

Grade 10 Selected Response Items with Bloom's

1. A chromosome is best described as a

   A gene that has more than one form.
   B green cell found in many plants.
   C reproductive cell found in certain kinds of bacteria.
   D strand of DNA and protein containing genetic information. *

Bloom's Level One: Knowledge
Students need to recall the definition of a chromosome; no analysis is needed.

2. Which liquid has the strongest intermolecular attractions?

A N_2 (ℓ)
B O_2 (ℓ)
C HCl (ℓ) *
D NH_3 (ℓ)

Bloom's Level Two: Comprehension

Students use their knowledge of how intermolecular attractions between particles can affect molecular properties. They evaluate the options based on their boiling points; the molecule with the highest boiling point will have the strongest intermolecular attraction.

3. Which method is the **most** effective in removing a salt from solution in water?

A Pour the solution through a paper filter.
B Pour the water from the solution.
C Allow the water to evaporate. *
D Use a magnet to attract the salt.

Bloom's Level Two: Comprehension

The process of separating salt from water is familiar to tenth grade students, but determining the "most effective" method for removing salt requires some evaluation.

4. Scientific theories that explain the formation of stars assume that stars begin as

A clouds of dust and gases pulled together by mutual gravitational attraction. *
B fragments of old comets, planets, and stars.
C massive bodies of radioactive material.
D much larger masses that have exploded, breaking into many stars.

Bloom's Level One: Knowledge

Students recall the theory of star formation.

5. Sponges are sessile (permanently attached organisms) and rely on water currents for their survival. Which biological process is **directly** affected by this way of life?

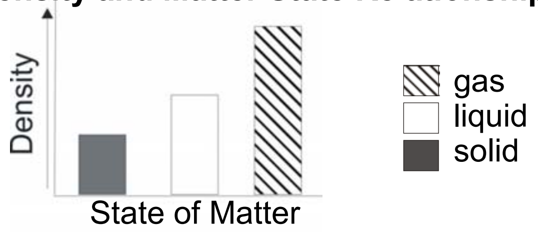
A development
B feeding *
C growth
D protein synthesis

Bloom's Level Three: Application

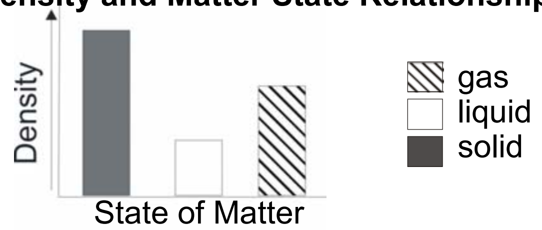
Sponges and their characteristics are relatively unfamiliar to tenth grade students. They must critically evaluate the affect an organism's ability to move about has on its various life processes, and then determine which process is affected most "directly."

6. Which graph **best** represents the relationship between the density of a substance and its state of matter (phase) for most Earth materials, excluding water?

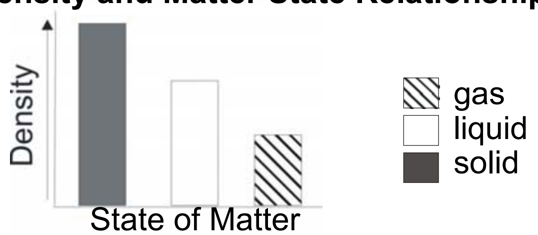
A **Density and Matter State Relationship**



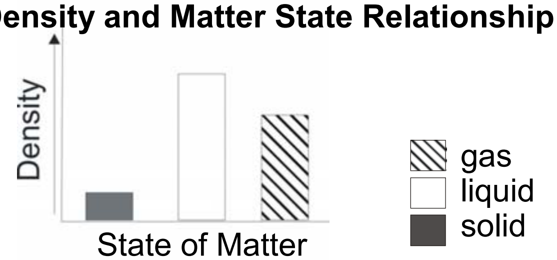
B **Density and Matter State Relationship**



C **Density and Matter State Relationship**



D **Density and Matter State Relationship**



Bloom's Level Two: Comprehension

Students translate their knowledge of how density changes in relationship to changes of state to determine which is the correct graph.

7. The figures below show the position of different elements on the periodic table. Which picture has an **X** in the locations of the three elements that would be most similar in the way they react?

A *

X		
X		
X		

B

X	X	X

C

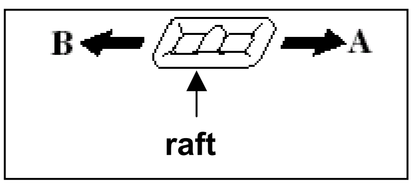
X		
	X	
		X

D

		X
	X	
X		

Bloom's Level Two: Comprehension
Students interpret the options given and apply their knowledge of the periodic table.

Use the diagram below to answer the next question.



8. If Abdul dives out of the raft in the direction indicated by arrow A, the boat will move in the direction indicated by arrow B. Which principle does this illustrate?
   - A Energy is neither created nor destroyed; it only changes form.
   - B Every action force results in an equal but opposite reaction force. *
   - C Mass can be converted into energy.
   - D Unless another force is applied, an object in motion will move at a constant speed.

Bloom's Level Two: Comprehension
Students interpret the diagram and its description, and match it to the correct concept from the options.

9. Which statement about plant and animal cells is true?

A Plant cells have a cell wall and a cell membrane; animal cells have a cell wall but not a cell membrane.

B Plant cells have a cell wall and chloroplasts; animal cells do not have either of these structures. *

C Plant cells have chloroplasts and mitochondria; animal cells have chloroplasts but do not have mitochondria.

D Plant cells have a nucleus and a cell wall; animal cells do not have either of these structures.

Bloom's Level One: Knowledge

Knowledge of specific facts, nothing further is required of students. The basic differences between plants and animals cell should be familiar to tenth grade students.

10. Kellie wants to find out if the rain in her town contains pollutants. The best way for Kellie to gather information would be to collect

A one sample each day on several rainy days.

B one sample on one rainy day.

C several separate samples on one rainy day.

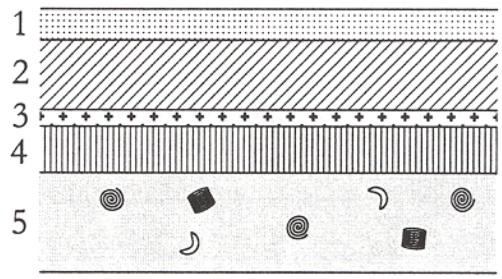
D several separate samples on several rainy days. *

Bloom's Level Two: Comprehension

Students use their knowledge of the scientific method to evaluate which is the best option for gathering information about Kellie's question.

Constructed Response Grade 10

Dating Rock Layers



Two measures of geologic time are absolute time, which relates to the year something happened, and relative time, which relates to the order or sequence in which events occurred. The figure above shows five rock layers. You have been asked to determine the age of rock layer 5.

A Describe **three** methods that could be used to determine the age of the rock layer. One of the three methods should be a method for determining **relative age** and one should be a method for determining **absolute age**.

B Explain how each of the methods you listed will identify the age of the rock layer.

Scoring Rubric

Score	Criteria
4	The response is complete and shows an in-depth understanding of relative and absolute time and how they are used to determine the age of rocks. There are accurate descriptions of three methods for dating rocks, including explanations of how the methods identify the rock's age. The response includes one method for determining relative age and one method for determining absolute age.
3	The response shows an understanding of relative and absolute time and how they are used to determine the age of rocks. There are descriptions of two or three methods for dating rocks, including explanations of how the methods identify the rock's age. The response includes one method for determining relative age and one method for determining absolute age, or two detailed descriptions for one type of dating; however, the response may lack detail or contain minor errors or misconceptions.
2	The response shows a limited understanding of relative and absolute age and how they are used to determine the age of rocks. The description includes one method for determining the age of rocks in detail or lists two or three methods with little or no explanation for each; however, the response contains errors, misconceptions, and omissions.
1	The response is incomplete and shows minimal understanding of relative and absolute time or how to determine the age of rocks. A method for dating rocks is described; however, the description contains major errors, misconceptions, and omissions.
0	The response is incorrect or contains no relevant information.
Blank	No response.

Science Behind the Question

Both relative and absolute times are needed to read a rock record.

Relative time places events in a sequence but does not identify their actual date of occurrence. The law of superposition states that in a series of undisturbed sedimentary rock, the oldest layer is on the bottom and the youngest on top. The law of crosscutting relationships states that a rock is younger than any rock it cuts into or across and igneous rock is younger than the rocks it has intruded. The law of included fragments states that pieces of one rock found in another rock must be older than the rock in which it is found. Fossil correlation states that rocks with the same set of fossils (called assemblages) are similar in age.

- Absolute time identifies the actual date of the event. Methods used for determining absolute age include radioactive dating, zircon dating, some fossil correlation, and rock layer sequencing by observation or core sampling. Comparison to events that have known dates (such as volcanic eruptions) can also be used.

Note: Although carbon-14 dating method is limited to about 50,000 years and so is not usable for most rocks, students will mostly be unfamiliar with other radioactive methods (uranium-lead, rubidium-strontium, potassium-argon), so the carbon method is accepted as representative of radioactive decay methods.

Student Responses

Score of 4

Student Response

To determine the age of layer 5, relative time could be found by determining the age of layer 4 and knowing that layer 5 would be older than layer 4. Absolute time would be found by two methods. If the fossils were carbon tested in layer 5, the layer of rock could almost be placed exactly in time, or if evidence of a disaster were found in layer 5, the known time of the disaster could unravel the age of layer 5. By knowing the age of the layers of rock above and below layer 5, the age of layer 5 could be placed between the two. Carbon testing is modern technology that is shown to be accurate and helpful. Disasters have been used before to place things and is dependable if the time-frame of the disaster is known.

Student accurately describes one method for determining the relative time of rock layer 5 (i.e., relative rock layer placement). Description includes an explanation of how the method works (i.e., determine the age of layer 4 which would be younger than layer 5).

Student accurately describes one method for determining the absolute time of rock (i.e., carbon testing). Description includes an explanation of how the method works (i.e., fossils found in layer would be carbon tested).

Student accurately describes another method for determining the absolute time of rock layer 5 (i.e., the presence of evidence of a known disaster). Description includes an explanation of how the method works (i.e., establishing the time of the known disaster establishes the time of layer 5).

Student provides additional information about two of the methods and how they work.

Overall, the student demonstrates a strong understanding of the different methods (relative and absolute) used to date rock layers. The student accurately describes one relative method (relative rock layer placement) and two absolute methods (carbon testing and evidence of known disaster) and explains how these methods work.

Score of 3

Student Response

a)

1) You could carbon date the rocks

2) to determine relative time you could say that rocks arrived or were formed after the dinosaurs were extint if you could find layers of dino remains in layers 1-4.

3) You could find something in the rock layer that relates to a specific time in history, that would show you the absolute time.

b) By carbon dating or finding something easily associated with the time it would be easy for scientists to find the age of the rock layers by using the forementioned methods.

Student describes one method for determining the age of rock layer 5 (i.e., carbon dating). Description includes a general explanation of how the method works (i.e., the rocks are carbon dated).

Student describes a method for determining the relative time of the rock layer 5 (i.e., examination of dinosaur fossils) and explains how this method works (i.e., determine the age of the dinosaur remains found in layers 1-4 to approximate the relative age of rock layer 5). Description includes a minor error. If the rock layer being dated is under the layers containing dinosaur fossils, it was formed before (not after) the others.

Student generally describes a method for determining the absolute time of rock layer 5 (i.e., “find something that relates to a specific time in history”). Description includes a general explanation of how the method works.

Student adds general information about the use of the first and third methods.

Overall, the student demonstrates a general understanding of the different methods (relative and absolute) used to date rock layers. The student describes three methods (one relative and two absolute) for determining the age of rock layer 5 and generally explains how these methods work.

Score of 2

Student Response

Rocks have been around for a long time in the idea of dating rocks is not an easy task as you are or have many different ways that you can choose to determine how old a rock is such as looking at the markings on a rock and the size of the rock and the texture of the rock this will not be able to get you an absolute date of the rock but will be able to know around how long that this rock has been on the earth.

If you were to try to find out the absolut date of the rock you would have to brake the rock and do a serious amount of testing on the rock in a lab or in a science place as something like that. In ageing of the rocks layers you are to look and you will automatically know that the age of the longest time will be the rock nearest to the bottom because the rock has already been formed and you will know that the lowest part would be the oldest in the years of the Rocks age.

Student describes one method of determining the age of a rock (i.e., examination of a rock's characteristics). This method is partially correct (i.e., some rocks do have layers that can be used for dating purposes), but the description lacks detail.

Student describes second method of determining the age of a rock (i.e., break the rock and "do a serious amount of testing on the rock in a lab"). The description lacks detail (e.g., the description does not describe the types of tests that should be done).

Student accurately describes a third method of determining the age of a rock layer (i.e., relative rock layer placement), although the description is somewhat unclear.

Overall, the student demonstrates some understanding of the different methods (relative and absolute) used to date rock layers. The student accurately describes one method (relative rock layer placement) and attempts to describe two other methods but the descriptions both lack detail.

Score of 1

Student Response

Three methods that determine the age of the rock layer include how wide it is. All the other layers are skinnier than this one. This layer is on the bottom so it is pretty old.

Student attempts to describe one method for determining the age of rock layer 5 (i.e., determine "how wide it is") but the method is incorrect.

Student correctly states that (layer 5) "is on the bottom so it is pretty old."

Overall, the student demonstrates a minimal understanding of the methods that can be used to date rock layers (relative and absolute) by correctly stating that layer 5 is older than the other layers above it.

APPENDIX A

CURRENT STEEAAC MEMBERS

Charles Adamchik Blairsville-Saltsburg School District	Richard Clevenstine Ridley School District
Kevin Andreyo Berks County Intermediate Unit	Richard Close Souderton Area School District
Kenneth Andrus Jersey Shore Area School District	Paul Conway Glendale School District
Donovan Augustin Westmoreland School District	Susan Courson Clarion University
Helen Ayers Retired	Kim Cuff Harrisburg School District
William Ayers Retired	Wayne Dallas North Penn School District
Steve Barbato Lower Merion School District	Sabriya Dempsey School District of Philadelphia
Rose Marie Barnhart Montrose Area School District	Mark Dietrich Upper Dauphin School District
Mathew Binder Hempfield School District	Chuck English Altoona Area School District
Kathleen Blouch Capital Area Institute for Math and Science	Daniel Engstrom California University of Pennsylvania
Susan Bower Newport School District	John Evans Delaware Co. Community College
Roy Boyle Pennsylvania State University	Deborah Farelli Mohawk School District
Jim Brotzman Spring-Ford Area School District	Ralph Feather, Jr. Derry Area School District
Kenneth Brown Hatboro-Horsham School District	James Filizzi Dallastown School District
Rochelle Bupp West York Area School District	Fred Frey Retired
Margaret Burton Capital Area Institute for Math and Science	David Gallaher Indiana University of PA
Christopher Campbell Derry Area School District	Karen Garner Penn Trafford School District
Thelma Caris Keystone Central School District	Perry Gemmill Millersville University
Joseph Cifelli Cheltenham Township School District	John Gimbel Great Valley School District
Grace Cisek Berks School District	Robert Ginther DuBois Area School District

Jennifer Goff Spring Grove Area School District
Catherine Grebner Archdiocese of Philadelphia
Linda Hagarty Abington School District
Judith Hawthorn West Shore School District
Marlene Hilkowitz School District of Philadelphia
Natalie Hiller Haverford School District
Jeffrey Holmes Pleasant Valley Area School District
Ambra Hook School District of Philadelphia
Kathleen Horstmeyer Lower Merion School District
Charles Humberd Red Lion School District
Joseph Huttline School District of Philadelphia
Roberta Jacoby Cheltenham School District
Uma Jayaraman School District of Philadelphia
Judy Jobes Millcreek Township School District
Sondra Jodkin Shaleer Area School District
Kathleen Jones Altoona Area School District
Randall Jones Altoona Area School District
Darlene Jones Pennridge School District
Deborah Jubas Northern Cambria School District
Richard Kline Haverford Township School District
Stan Komacek California University of PA
Susan Kostovny Baldwin-Whitehall School District

Barbara Lease Penn Hills School District
Donna Lease PA Building a Presence for Science
John Lencioni Milton Hershey School
Len Litowitz Millersville University
Bates Mandel School District of Philadelphia
Ruth Martin Pittsburgh Public Schools
Beth Martin West Chester Area School District
Susan McCabe Penn Trafford School District
Joe McCade Millersville University
Crystal McGee Southern York School District
Katherine Metrick Northwestern Lehigh School District
Bill Metz Pennridge School District
Timothy Miller Dallastown School District
Robert Moreland Dallastown School District
Wayne Muller Stroudsburg Area School District
Mary Nagel Pittsburgh Public Schools
Mark Nowak California University
Elizabeth O’Neil Norristown Area School District
Christie Orlosky Armstrong School District
Elaine Paulishak Mid Valley School District
Gail Peddle School District of Philadelphia
Janet Peterson Warren County School District

Patricia Phillips Pittsburg Public Schools
Debbie Pro Canon-McMillan School District
Sr. John Ann Proach St. John Evangelist School
Michael Ranck Hamburg Area School District
Charles Rodkey Keystone Oaks School District
Charles Rohart, II Tamaqua School District
Clair Roudebush Millersville University
George Rumpp Colonial School District
Phyllis Rumpp Lower Merion School District
Ruth Ruud Millcreek Township School District
William Ryding Kane Area School District
H. Jean Sinal Hollidaysburg Area School District
Charles Sosko ASSET
Rebecca Speelman Conewago Valley School District
Donnan Stoicovy State College Area School District
Eva Strang North Star School District
Kristine-Marie Strausbaugh South Western School District
Jes Sunder Venango Technology Center
Donna Taylor Dallastown School District

Betty Jean Thompson School District of Philadelphia
Phyllis Thompson School District of Philadelphia
Andrea Tongen Grove City Area School District
Geno Torri Chambersburg School District
Joanne Trombley West Chester Area School District
Maribeth Valentine Quaker Valley School District
Daniel Vandenberg Springfield Delco School District
Kate Walsh Montrose Area School District
Barry Walton Manheim Township School District
Glenn Weber Norristown Area
Ranjini Weerasooriya Temple University
Ben White Northern Potter School District
George White Athens Area School District
Teresa White Athens Area School District
Douglas Whitehill Dallastown Area School District
Kenneth Zellner Parkland School District
Matt Zimmerman Dallastown Area School District
Richard Zimmerman Crestwood School District