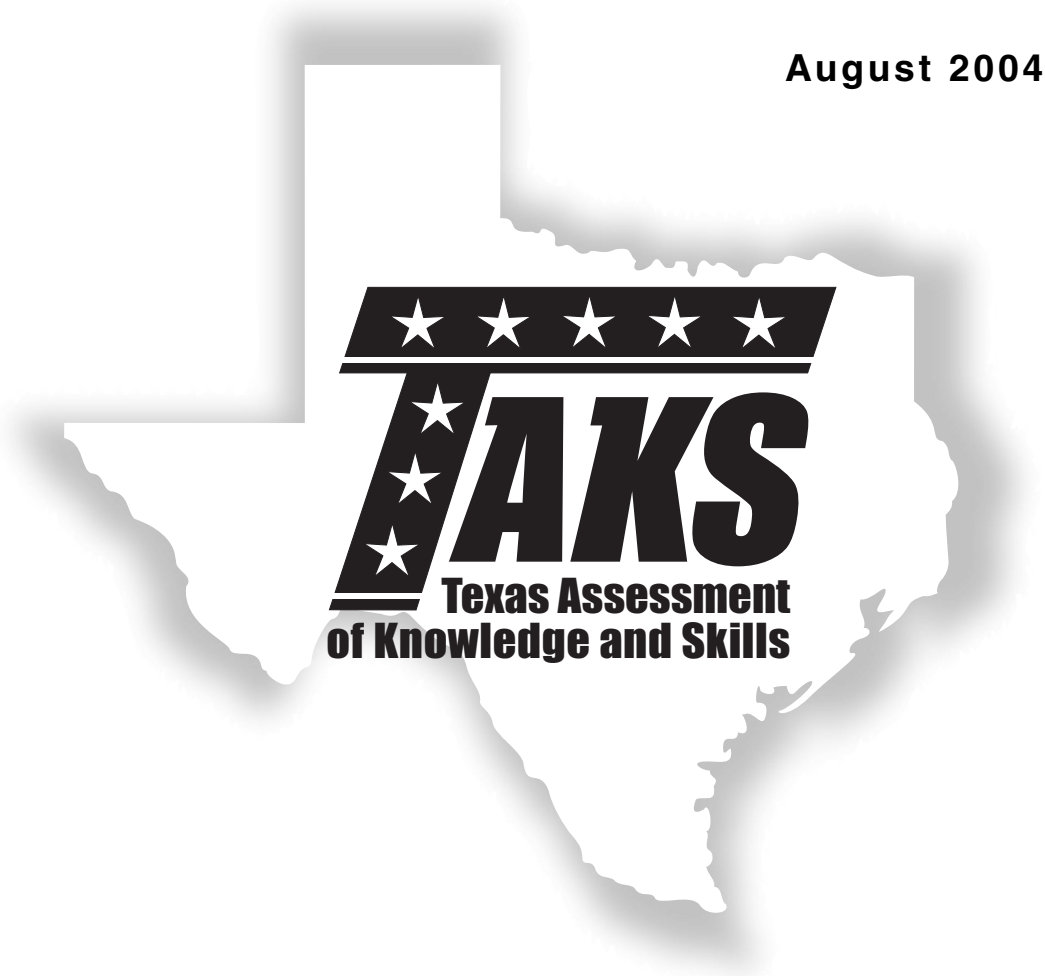
August 2004



Information Booklet

Elementary Science
Grade 5
Revised

Texas Education Agency • Student Assessment Division

INTRODUCTION

The Texas Assessment of Knowledge and Skills (TAKS) is a completely reconceived testing program. It assesses more of the Texas Essential Knowledge and Skills (TEKS) than the Texas Assessment of Academic Skills (TAAS) did and asks questions in more authentic ways. TAKS has been developed to better reflect good instructional practice and more accurately measure student learning. We hope that every teacher will see the connection between what we test on this new state assessment and what our students should know and be able to do to be academically successful. To provide you with a better understanding of TAKS and its connection to the TEKS and to classroom teaching, the Texas Education Agency (TEA) has developed this newly revised edition of the TAKS information booklet. The information booklets were originally published in January 2002, before the first TAKS field test. Now, after several years of field tests and live administrations, we are able to provide an even more comprehensive picture of the testing program. We have clarified some of the existing material and, in some cases, provided new sample items and/or more explanations of certain item types. However, it is important to remember that these clarifications do not signify any change in the TAKS testing program. The objectives and TEKS student expectations assessed on TAKS remain unchanged. We hope this revised version of the TAKS information booklet will serve as a user-friendly resource to help you understand that the best preparation for TAKS is a coherent, TEKS-based instructional program that provides the level of support necessary for all students to reach their academic potential.

BACKGROUND INFORMATION

The development of the TAKS program included extensive public scrutiny and input from Texas teachers, administrators, parents, members of the business community, professional education organizations, faculty and staff at Texas colleges and universities, and national content-area experts. The agency took these steps to involve as many stakeholders as possible because we believed that the development of TAKS was a responsibility that had to be shared if this new assessment was to be an equitable and accurate measure of learning for all Texas public school students.

The three-year test-development process, which began in summer 1999, included a series of carefully conceived activities. First, committees of Texas educators identified those TEKS student expectations for each grade and subject area assessed that should be tested on a statewide assessment. Then a committee of TEA Student Assessment and Curriculum staff incorporated these selected TEKS student expectations, along with draft objectives for each subject area, into eleventh-grade exit level surveys. These surveys were sent to Texas educators at the middle school and secondary levels for their review. Based on input we received from more than 27,000 survey responses, we developed a second draft of the objectives and TEKS student expectations. In addition, we used this input during the development of draft objectives and student expectations for grades 3 through 10 to ensure that the TAKS program, like the TEKS curriculum, would be vertically aligned. This vertical alignment was a critical step in ensuring that the TAKS tests would become more rigorous as students moved from grade to grade. For example, the fifth grade tests would be more rigorous than the fourth grade tests, which would be more rigorous than the third grade tests. Texas educators felt that this increase in rigor from grade to grade was both appropriate and logical since each subject-area test was closely aligned to the TEKS curriculum at that grade level.

In fall 2000 TEA distributed the second draft of the objectives and TEKS student expectations for eleventh grade exit level and the first draft of the objectives and student expectations for grades 3 through 10 for review at the campus level. These documents were also posted on the Student Assessment Division's website to encourage input from the public. Each draft document focused on two central issues: first, whether the objectives included in the draft were essential to measure on a statewide assessment; and, second, whether students would have received enough instruction on the TEKS student expectations included under each objective to be adequately prepared to demonstrate mastery of that objective in the spring of the school year. We received more than 57,000 campus-consensus survey responses. We used these responses, along with feedback from national experts, to finalize the TAKS objectives and student expectations. Because the state assessment was necessarily limited to a "snapshot" of student performance, broad-based input was important to ensure that TAKS assessed the parts of the TEKS curriculum most critical to students' academic learning and progress.

In the thorough test-development process that we use for the TAKS program, we rely on educator input to develop items that are appropriate and valid measures of the objectives and TEKS student expectations the items are designed to assess. This input includes an annual educator review and revision of all proposed test items before field-testing and a second annual educator review of data and items after field-testing. In addition, each year a panel of recognized experts in the fields of English language arts (ELA), mathematics, science, and social studies meet in Austin to critically review the content of each of the high school level TAKS assessments to be administered that year. This critical review is referred to as a content validation review and is one of the final activities in a series of quality-control steps to ensure that each high school test is of the highest quality possible. A content validation review is considered necessary at the high school grades (9, 10, and 11) because of the advanced level of content being assessed.

ORGANIZATION OF THE TAKS TESTS

TAKS is divided into test objectives. It is important to remember that the objective statements are not found in the TEKS curriculum. Rather, the objectives are "umbrella statements" that serve as headings under which student expectations from the TEKS can be meaningfully grouped. Objectives are broad statements that "break up" knowledge and skills to be tested into meaningful subsets around which a test can be organized into reporting units that help campuses, districts, parents, and the general public understand the performance of our students and schools. Test objectives are not intended to be "translations" or "rewordings" of the TEKS. Instead, the objectives are designed to be identical across grade levels rather than grade specific. Generally, the objectives are the same for third grade through eighth grade (an elementary/middle school system) and for ninth grade through eleventh grade (a high school system). In addition, certain TEKS student expectations may logically be grouped under more than one test objective; however, it is important for you to understand that this is not meaningless repetition—sometimes the organization of the objectives requires such groupings. For example, on the TAKS writing tests for fourth and seventh grades, some of the same student expectations addressing the conventions of standard English usage are listed under both Objective 2 and Objective 6. In this case, the expectations listed under Objective 2 are assessed through the overall strength of a student's use of language conventions on the written composition portion of the test; these same expectations under Objective 6 are assessed through multiple-choice items attached to a series of revising and editing passages.

ORGANIZATION OF THE INFORMATION BOOKLETS

The purpose of the information booklets is to help Texas educators, students, parents, and other stakeholders understand more about the TAKS tests. These booklets are not intended to replace the teaching of the TEKS curriculum, provide the basis for the isolated teaching of skills in the form of narrow test preparation, or serve as the single information source about every aspect of the TAKS program. However, we believe that the booklets provide helpful explanations as well as show enough sample items, reading and writing selections, and prompts to give educators a good sense of the assessment.

Each grade within a subject area is presented as a separate booklet. However, it is still important that teachers review the information booklets for the grades both above and below the grade they teach. For example, eighth grade mathematics teachers who review the seventh grade information booklet as well as the ninth grade information booklet are able to develop a broader perspective of the mathematics assessment than if they study only the eighth grade information booklet.

The information booklets for each subject area contain some information unique to that subject. For example, the mathematics chart that students use on TAKS is included for each grade at which mathematics is assessed. However, all booklets include the following information, which we consider critical for every subject-area TAKS test:

- an overview of the subject within the context of TAKS
- a blueprint of the test—the number of items under each objective and the number of items on the test as a whole
- information that clarifies how to read the TEKS
- the reasons each objective and its TEKS student expectations are critical to student learning and success
- the objectives and TEKS student expectations that will be included on TAKS
- additional information about each objective that will help educators understand how it is assessed on TAKS
- sample items that show some of the ways objectives are assessed

What Every Teacher Needs to Know About the TAKS Science Tests

Why do we test science?

As teachers and parents, we are preparing our children to be the next generation of educated and concerned citizens. An understanding of science will help our children be better informed and more capable of making decisions that will affect their lives and the environment. Being scientifically literate cannot be defined as simply having the ability to remember scientific facts; scientific literacy involves much more than that. It means that our students will not only understand important science concepts but also be able to apply what they know to the health, safety, and environmental issues that are at the center of our everyday lives. Science assessments play a critical role in determining whether our students are mastering the science knowledge and skills they need in order to be scientifically literate and academically successful.

What is the science TAKS based on?

The TAKS is based on the state-mandated science curriculum, the Texas Essential Knowledge and Skills (TEKS). All four science assessments were developed using selected knowledge and skills statements and student expectations from the science TEKS. The elementary science test was based on eligible science TEKS from grades 2–5. The middle school science test will be based on selected science TEKS from grades 6–8. The grade 10 and the exit level TAKS tests are based on selected TEKS for Integrated Physics and Chemistry (IPC) and Biology.

The TEKS were created to align closely with the *National Science Standards*, *Benchmarks for Science Literacy*, and *Science for All Americans*. These books are an excellent resource for guidance in finding grade-appropriate strategies for teaching many science concepts.

How were the TEKS chosen to be on TAKS?

The science TEKS knowledge and skills statements and student expectations eligible for assessment were determined to be appropriate for TAKS by educator review committees; feedback from over 74,000 surveys completed by Texas educators in 2000 and 2001 and input from national reviewers further refined the objectives. Because of the constraints of a single statewide assessment, not all science TEKS can be addressed.

> Although some student expectations within the TEKS are not assessed, it is important that educators teach all of the science curriculum so that students can develop a complete understanding of critical science concepts.

How are the TEKS organized within the TAKS?

The knowledge and skills statements, with their associated student expectations, are organized under objectives on the TAKS. These objectives group the eligible student expectations into categories with similar content and are used for score-reporting purposes. The elementary test has four objectives. The middle school, grade 10, and exit level tests have five objectives.

How do the knowledge and skills statements relate to items on the TAKS science tests?

Every item developed for the TAKS is grounded in the knowledge and skills statements. For example, in IPC (8)(C), students "investigate and identify the law of conservation of mass." This concept will be assessed within the framework of the overriding knowledge and skills statement, which reads, "The student knows that changes in matter affect everyday life."

Where does middle school fit in?

In 2003 the state legislature in Senate Bill 1108 mandated a middle school science test to be given at grade 8 no later than the 2006–2007 school year. The middle school science test will have five objectives that will include science TEKS from grades 6–8.

All educators should work together to align the curriculum across all grade levels so that unifying themes (strands) of learning are reinforced. TEKS instruction throughout elementary and middle school will lay the foundation for biology, chemistry, physics, and earth science concepts taught in high school.

What are "unifying themes"?

The science TEKS contain unifying themes, or conceptual strands, that are developed across grade levels in a grade-appropriate progression. To ensure proper teaching of the TEKS, educators should ensure that learning is connected throughout the grade levels and that there are varied opportunities for students to learn the concepts within a strand.

An example of a "systems" strand is given below:

(2.9) **Science concepts.** The student knows that living organisms have basic needs. The student is expected to

(B) compare and give examples of the ways living organisms depend on each other and on their environments. (Tested at grade 5)

(7.12) **Science concepts.** The student knows that there is a relationship between organisms and the environment. The student is expected to

(B) observe and describe how organisms, including producers, consumers, and decomposers, live together in an environment and use existing resources. (Tested at grade 8)

Biology (12) Science concepts. The student knows that interdependence and interactions occur within an ecosystem. The student is expected to

(E) investigate and explain the interactions in an ecosystem including food chains, food webs, and food pyramids. (Tested at grade 10)

Biology (9) Science concepts. The student knows metabolic processes and energy transfers that occur in living organisms. The student is expected to

(D) analyze the flow of matter and energy through different trophic levels and between organisms and the physical environment. (Tested at exit level)

How are science integrations and interdisciplinary issues handled on the TAKS science tests?

It is essential for teachers to expose students to science content in a variety of ways. Teachers must also help students make connections among the science disciplines by showing the natural integrations among the life, earth, and physical sciences. An example of this might be when students study different soil types (earth science) and learn how nutrients (chemistry) in the soil affect the types of plants (biology) that grow there.

Teachers should emphasize to students that science is not isolated from the other academic disciplines. The development of reading, writing, and mathematical skills will help students understand and communicate scientific ideas.

Is there a State-Developed Alternative Assessment (SDAA II) for the TAKS science tests?

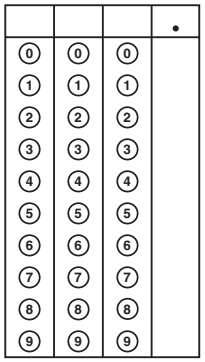
Currently, there is not an SDAA II for TAKS science at any grade. Therefore, the admission, review, and dismissal (ARD) committee can recommend that a student take the grades 5, 8, 10, and exit level science assessment, if appropriate. If the ARD committee determines that the TAKS science tests are not an appropriate assessment for a specific student, then the student may be exempt. However, if a student is exempted, the ARD committee must determine the type of Locally Developed Alternative Assessment (LDAA) the student must take. An LDAA can be a portfolio, a modified released test, or any other locally developed assessment that the ARD committee deems appropriate.

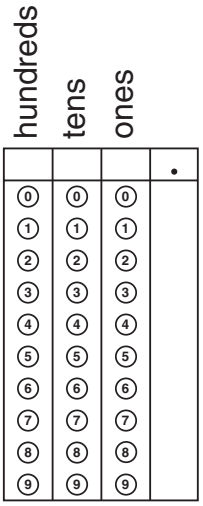
What is the format of the TAKS science tests?

Most items will be in a multiple-choice format with four options. Some multiple-choice items will be written as part of a cluster. A cluster will have a stimulus, which may be a diagram, a brief passage, a chart, or a combination of these, followed by a series of items that will involve the application of prior knowledge and analysis of the given information. Cluster items will appear together on the TAKS test, but items may not always appear on facing pages.

A limited number of items will be griddable, requiring students to bubble responses on grids that are the same as those used in the TAKS mathematics tests. The griddable format is intended to give students the opportunity to solve a problem or measure with precision and then determine an appropriate answer independently. The level of precision necessary for an item will be given to the student in the item. For instance, an item may direct the student to measure an object to the nearest millimeter.

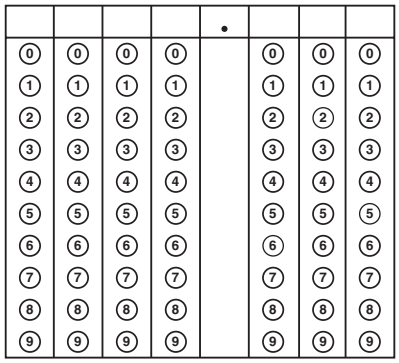
A three-column grid will be the only type of grid for the Elementary Science—Grade 5 TAKS test. The same grid format is used in the grade 5 TAKS Mathematics test. Answers must be recorded in the column of the correct place value. See the following examples:





The decimal on the grid defines the place values of the columns that precede it. Students must record their answer on the grid using the correct place values.

A seven-column grid will be the only type of grid for the grade 10 and exit level TAKS Science tests. The same grid format is used in the grade 10 and exit level TAKS Mathematics tests.



The decimal on the grid defines the place values of the columns that precede it. Students must record their answer on the grid using the correct place values. If an answer is a whole number, students may add zeros after the decimal, or if the answer is fractional, students may add a zero in front of the decimal.

Will any of the TAKS science tests be performance based?

The only performance testing that will occur on the TAKS science tests is using a ruler to measure with precision. Some items will require students to physically use a ruler to measure a drawing of an object in centimeters or millimeters.

> Remember that when the 20-centimeter paper ruler or measurement item that accompanies the TAKS science test is photocopied, the image may be distorted and improper measurements can result.

What is the purpose of the highlights that appear after each objective?

The highlights that appear after each objective are meant to clarify some of the student expectations in the TEKS. These highlights focus attention on some of the important aspects of certain student expectations and explain how these expectations might be assessed on the TAKS science tests. The highlights came from comments and concerns expressed on teacher surveys and in educator meetings.

Introduction to Elementary Science—Grade 5 TAKS

Who will be required to take the Elementary Science—Grade 5 TAKS?

All fifth-grade students will be required to take the TAKS elementary science test unless exempted by an admission, review, and dismissal (ARD) committee or a language proficiency assessment committee (LPAC). For more information about ARD and LPAC committees, refer to *ARD Committee Decision-Making Process for the Texas Assessment Program* and *LPAC Decision-Making Process for the Texas Assessment Program (Grades 3–10)*.

The elementary science test will be available in English and Spanish. This information booklet has been translated into Spanish.

What TEKS will be included on the Elementary Science—Grade 5 TAKS?

The grade 5 TAKS is a comprehensive elementary assessment. Even though the test is given at fifth grade, it will cover science TEKS from grades 2, 3, 4, and 5.

How should the TEKS be approached at the elementary level?

Students learn science by doing science. At the elementary level, science process skills and content can be learned through integrated activities and hands-on experiences. Students should be observing the world around them as they develop an understanding of how it works. The elementary science TEKS (grades 1–5) were developed to provide students with multiple experiences that require the use of their senses to examine concrete examples of science phenomena. For example, students could compare learned behaviors to inherited traits by observing family pets or classroom animals. Students should have access to many resources besides classroom textbooks and kits for exploring science content. Exploration through concrete experiences will prepare students for the study of science concepts in greater depth at middle and high school.

How important is elementary science education?

Although students naturally explore the world around them, elementary science education, beginning in kindergarten, is their first formal experience with the skills and concepts associated with science and scientific methods. In elementary science, students will be given the foundation of knowledge and skills necessary for the application of scientific concepts throughout their everyday lives and academic experiences.

What is the role of the untested TEKS in the elementary assessment?

Some student expectations are not tested, yet all the TEKS are critical for students' overall understanding of science. For example, student expectation (5.12)(D), "identify gravity as the force that keeps planets in orbit around the Sun and the moon in orbit around the Earth," is not tested, but students must understand this concept in order to successfully answer items on student expectation (5.12)(C), "identify the physical characteristics of the Earth and compare them to the physical characteristics of the moon," which is tested.

Although some student expectations within the TEKS are not assessed, it is important that educators teach all of the science curriculum so that students can develop a complete understanding of critical science concepts.

What types of equipment may be referenced on the TAKS elementary science test?

Students will be expected to have experience using all of the equipment and supplies commonly used in first through fifth grades. This list includes calculators, microscopes, cameras, sound recorders, computers, hand lenses, rulers, thermometers, compasses, triple-beam or double-pan balances, hot plates, meter sticks, timing devices, magnets, cylinders with graduations, collecting nets, and safety goggles. Please refer to the TEKS grades 1–5 for a complete list of all the equipment students should have experience with.

ELEMENTARY SCIENCE—GRADE 5 TAKS BLUEPRINT

TAKS Objectives	Number of Items
Objective 1: Nature of Science	13
Objective 2: Life Science	9
Objective 3: Physical Science	9
Objective 4: Earth/Space Science	9
Total number of items scored	**40**
Field test items	10
Total items on test	**50**

The Elementary Science TAKS blueprint will remain the same from one testing cycle to the next.

A Key to Understanding the TEKS Included on TAKS Elementary Science

Example from Objective 1

A

(5.3) **Scientific processes.** The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to

C

B → (A) analyze, review, [and critique] scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information.

KEY

A. Knowledge and Skills Statement

This broad statement describes what students should know and be able to do for fifth-grade science. The number preceding the statement identifies the number of the knowledge and skills statement. It is important to read the knowledge and skills statement along with the student expectations associated with it for a full understanding of the concept.

B. Student Expectation

This specific statement describes what students should be able to do to demonstrate proficiency in what is described in the knowledge and skills statement. Students will be tested on skills outlined in the student expectation statement.

C. [bracketed text]

The student expectation has been presented in its entirety for two reasons: to clarify the link to the curriculum and to provide background information for test items. However, bracketed text will not be specifically tested on the TAKS.

NOTE: The full TEKS curriculum can be found at http://www.tea.state.tx.us/teks/.

TEKS STUDENT EXPECTATIONS—IMPORTANT VOCABULARY

For every subject area and grade level, two terms—*such as* and *including*—are used to help make the TEKS student expectations more concrete for teachers. However, these terms function in different ways. To help you understand the effect each of the terms has on specific student expectations, we are providing the following:

- a short definition of each term
- an example from a specific student expectation for this subject area
- a short explanation of how this term affects this student expectation

Such as

The term *such as* is used when the specific examples that follow it function only as representative illustrations that help define the expectation for teachers. These examples are just that—examples. Teachers may choose to use them when teaching the student expectation, but there is no requirement to do so. Other examples can be used in addition to those listed or as replacements for those listed.

Science (4.6)(A) "The student is expected to identify patterns of change such as in weather, metamorphosis, and objects in the sky."

For this student expectation, students must understand that events and objects in the natural world will change over time. These changes usually occur in patterns. The examples listed in this student expectation are very common examples that most students will be familiar with and that are easy to demonstrate in the classroom. However, there are many other examples that can be used, and the list of examples in this student expectation is not exhaustive or exclusive.

Including

The term *including* is used when the specific examples that follow it must be taught. However, other examples may also be used in conjunction with those listed.

Science (5.7)(A) "The student is expected to classify matter based on its physical properties including magnetism, physical state, and the ability to conduct or insulate heat, electricity, and sound."

This expectation lists some of the properties that students must be able to use in order to classify matter. Other properties, such as solubility or hardness, can be used as well as those listed, but it is required that students be able to use the properties in the student expectation.

Remember

For the TAKS tests, teachers should remember two things with regard to these terms.

- Any example preceded by the term *such as* in a particular student expectation may or may not provide the basis for an item assessing that expectation. Because these examples do not necessarily have to be used to teach the student expectation, it is equally likely that other examples may be used in assessment items. The rule here is that an example be used only if it is central to the knowledge, concept, or skill the item assesses.
- It is more likely that some of the examples preceded by the term *including* in a particular student expectation will provide the basis for items assessing that expectation, since these examples must be taught. However, it is important to remember that the examples that follow the term *including* do not represent all of the examples possible, so other examples may also provide the basis for an assessment item. As above, the rule here is that an example should be used only if it is central to the knowledge, concept, or skill the item assesses.

TEXAS ASSESSMENT OF KNOWLEDGE AND SKILLS
ELEMENTARY SCIENCE—GRADE 5

Objective 1: The student will demonstrate an understanding of the nature of science.

Objective 1 is focused on the student as a scientist. This objective is found in grades 5, 8, 10, and exit level. The nature of science is at the heart of all sciences, K–16. The skills developed in Objective 1 progress in sophistication and complexity as the student matures and advances academically. In order to understand scientific processes, students must perform the activities of scientists, which include making observations, collecting data, and drawing conclusions. For instance, student expectation (5.2)(B) states that students are expected to "collect information by observing and measuring." Rather than just lecturing to students on how to use lab equipment, the teacher should give students the opportunity to work with thermometers, balances, measuring cups, and other lab equipment.

Activities related to the TEKS of Objective 1 develop students' critical-thinking skills and problem-solving abilities. Using critical-thinking skills to apply science concepts is the primary goal of science education. To best develop these skills, scientific processes should be taught and reinforced throughout the curriculum instead of as an isolated unit.

(3.1, 4.1, 5.1) **Scientific processes.** The student conducts field and laboratory investigations following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to

(A) demonstrate safe practices during field and laboratory investigations.

(3.2, 4.2, 5.2) **Scientific processes.** The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to

(A) plan and implement descriptive and simple experimental investigations including asking well-defined questions, formulating testable hypotheses, and selecting and using equipment and technology;

(B) collect information by observing and measuring;

(C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;

(D) communicate valid conclusions; and

(E) construct simple graphs, tables, maps, and charts using tools [including computers] to organize, examine, and evaluate information.

**Note: The knowledge and skills statements and the student expectations listed above are exactly the same for grades 3, 4, and 5.

(3.3, 4.3, 5.3) **Scientific processes.** The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to

(A) analyze, review, [and critique] scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

(B) draw inferences based on information [related to promotional materials] for products and services; and

(C) represent the natural world using models and identify their limitations.

(3.4, 4.4, 5.4) **Scientific processes.** The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to

(A) collect and analyze information using tools including calculators, microscopes, [cameras, sound recorders, computers,] hand lenses, rulers, thermometers, compasses, balances, [hot plates,] meter sticks, timing devices, magnets, collecting nets, and safety goggles (5.4).

**Note: The knowledge and skills statement listed above is the same for grades 3, 4, and 5. Although student expectation A for grades 3 and 4 is not listed under this knowledge and skills statement, students are expected to be familiar with all the equipment for elementary science.

Highlights of Objective 1

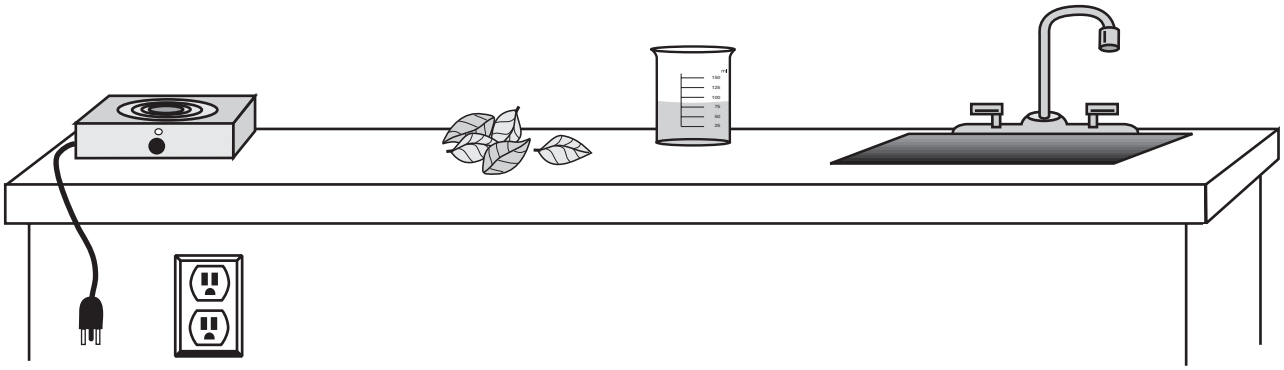
- Scientists use many methods and tools in their research. Students should learn a variety of methods and different tools to solve problems and make sense of the world.
- Students should be actively participating in laboratory and field activities. Classrooms, hallways, school grounds, and community resources can be used for these investigations.
- *Texas Safety Standards*, which can be obtained through the Texas Education Agency's Office of Publications, should be referenced as students learn about and use safe practices in the classroom, laboratory, and field.
- Students should be able to use evidence to evaluate the strengths and weaknesses of a scientific explanation of a given phenomenon, determine if the explanation makes sense based on the evidence, and then explain how they arrived at their conclusions.
- The use of the tools, equipment, and materials included in the elementary science TEKS from first through fifth grades will be assessed in this objective. Students will be required to make precise measurements from illustrations. Students may be asked to read masses from triple-beam or double-pan balances, volumes from cylinders that are graduated, such as rain gauges, and temperatures from thermometers. They may also be asked to determine the lengths in both centimeters and millimeters of objects using a 20-centimeter paper ruler provided as part of the test materials.

- Models can be used to represent the natural world. Models are used to study objects and events whose size and scope may make them difficult to study or explain. Students should understand that models are not perfect representations and have limitations.

- Activities related to the TEKS of Objective 1 develop students' critical-thinking skills and problem-solving abilities. Using critical-thinking skills to apply science concepts is the primary goal of science education. To best develop these skills, scientific processes should be taught and reinforced throughout the curriculum instead of as an isolated unit.

- Students are expected to understand that repeated trials may increase the reliability of results, even if that concept is not directly assessed.

Objective 1 Sample Items



1 When entering the classroom, a student sees a lab setup. What should the student do next?

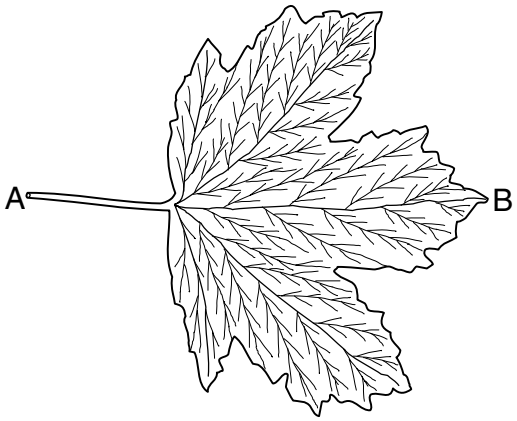
A Turn on the water faucet

B Cut the leaves into small pieces to prepare for the experiment

C Organize the lab equipment so everything is ready to begin

D* Wait for the teacher to give instructions

(5.1)(A)
This item requires students to be familiar with proper lab procedures and safety. When entering a lab area, students should not begin to work without supervision from the teacher. Many items will emphasize the importance of doing scientific experiments and assume students have had experience in a science lab setting.



2 Using the centimeter ruler, measure the length of this leaf from point A to point B to the nearest centimeter. Record and bubble in your answer on the answer document.

		6	.
⓪	⓪	⓪	
①	①	①	
②	②	②	
③	③	③	
④	④	④	
⑤	⑤	⑤	
⑥	⑥	⑥	
⑦	⑦	⑦	
⑧	⑧	⑧	
⑨	⑨	⑨	

(5.2)(B)

This item requires students to use the 20-centimeter ruler provided and to have knowledge of place value to the nearest centimeter or whole number. The decimal on the grid defines the place values of the columns that precede it. Students must record their answer on the grid using the correct place values. For example, the answer to this item is 6; therefore, the number should be written in the box that represents the ones place value.

3 The drawing shows a model of the Earth, moon, and sun system made from foam balls. What is one way to make this model more accurate?

A Use wooden blocks instead of foam balls

B* Make the sun larger than the Earth and the moon smaller

C Move the sun closer to the Earth

D Change the order of the foam balls to be moon, sun, Earth

(5.3)(C)
This item requires students to determine how to improve a model. Students need to be familiar with the size of Earth relative to the sun and the moon. This item requires students not only to critique a model but also to apply content knowledge. Other items based on this student expectation may ask students to determine whether something is missing from a model or to identify what is inaccurate about a model.

Watering Schedules

Frequency	Average Plant Growth (mm)
Every day	3
Every 2 days	8
Every 4 days	5
Every 7 days	1

4 For two weeks, groups of plants of the same type were watered on four different schedules. According to the information in the table, this type of plant grows best if watered every —

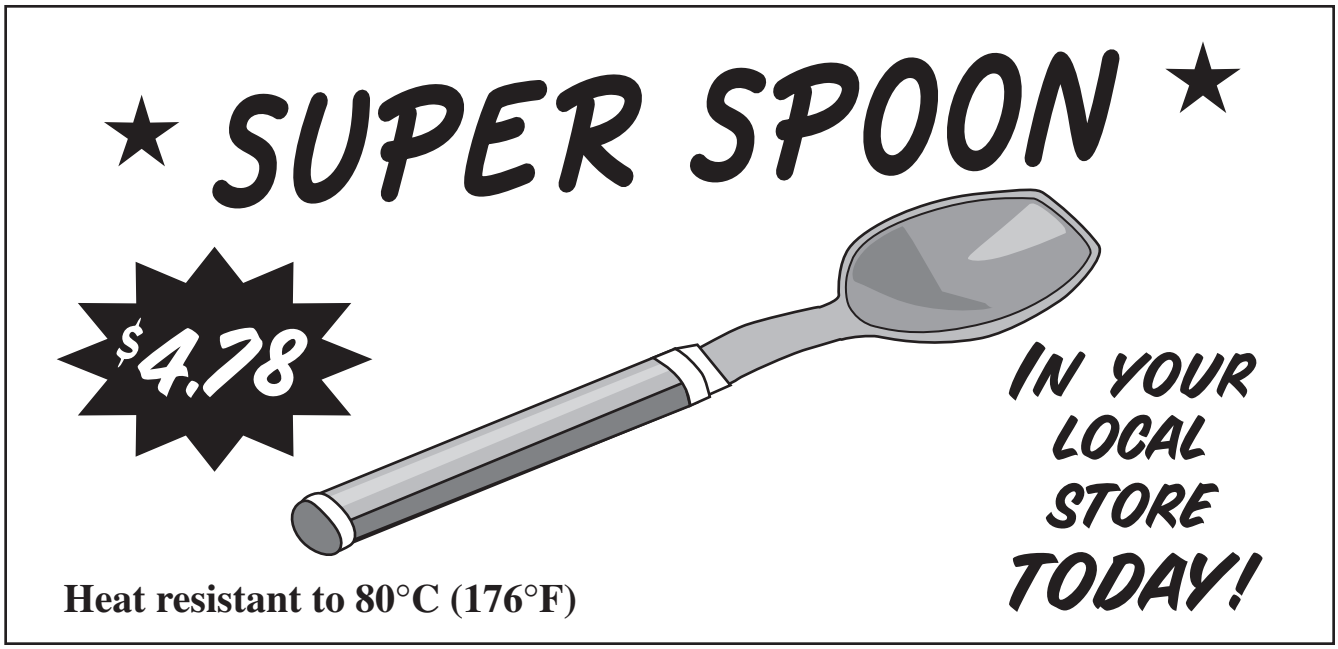
A day

B* 2 days

C 4 days

D 7 days

(5.2)(D)
This item requires students to analyze data presented in a chart and draw conclusions based on the data.



5 A Super Spoon should not be used to scrape out a —

A bowl of cookie dough

B carton of frozen ice cream

C dish of cake mix

D* pan of boiling oatmeal

(5.3)(B)
This item requires students to examine the advertisement and "look at the small print," recognizing that 80°C is below the boiling point of water and that the Super Spoon cannot be used for all purposes.

Objective 2: The student will demonstrate an understanding of the life sciences.

This objective assesses students' understanding of inherited traits and the diversity of life through a focus on the similarities and differences between organisms. The objective also addresses the basic needs of living organisms through the study of the traits and behaviors of plants and animals in different environments. The concepts of evolution, ecology, and genetics are introduced at their most fundamental levels for the Elementary Science—Grade 5 TAKS test.

Students need to understand that they are interconnected with the world around them. Awareness of this interdependence will enable them to be better informed when making decisions concerning their health, their well-being, and their environment. Through the study of populations, students begin to see themselves as part of an ecosystem. The life science concepts learned in the elementary grades provide the foundation for the biological concepts tested on the grades 8, 10, and exit level TAKS.

(2.9) **Science concepts.** The student knows that living organisms have basic needs. The student is expected to

(A) identify the external characteristics of different kinds of plants and animals that allow their needs to be met; and

(B) compare and give examples of the ways living organisms depend on each other and on their environments.

(3.8) **Science concepts.** The student knows that living organisms need food, water, light, air, a way to dispose of waste, and an environment in which to live. The student is expected to

(A) observe and describe the habitats of organisms within an ecosystem;

(B) observe and identify organisms with similar needs that compete with one another for resources such as oxygen, water, food, or space;

(C) describe environmental changes in which some organisms would thrive, become ill, or perish; and

(D) describe how living organisms modify their physical environment to meet their needs such as beavers building a dam or humans building a home.

(4.6) **Science concepts.** The student knows that change can create recognizable patterns. The student is expected to

(A) identify patterns of change such as in weather, metamorphosis, and objects in the sky.

(5.5) **Science concepts.** The student knows that a system is a collection of cycles, structures, and processes that interact. The student is expected to

(A) describe some cycles, structures, and processes that are found in a simple system; and

(B) describe some interactions that occur in a simple system.

(5.6) **Science concepts.** The student knows that some change occurs in cycles. The student is expected to

(C) describe and compare life cycles of plants and animals.

(4.8, 5.9) **Science concepts.** The student knows that adaptations may increase the survival of members of a species. The student is expected to

(A) compare the adaptive characteristics of species that improve their ability to survive and reproduce in an ecosystem (5.9);

(B) analyze and describe adaptive characteristics that result in an organism's unique niche in an ecosystem (5.9); and

(C) predict some adaptive characteristics required for survival and reproduction by an organism in an ecosystem (5.9).

(3.10, 4.9, 5.10) **Science concepts.** The student knows that likenesses between offspring and parents can be inherited or learned. The student is expected to

(A) identify traits that are inherited from parent to offspring in plants and animals (5.10); and

(B) give examples of learned characteristics that result from the influence of the environment (5.10).

NOTE: Systems, patterns, and changes are addressed in Objectives 2, 3, and 4 because these unifying themes cut across content areas. The knowledge and skills statements (5.5) "The student knows that a system is a collection of cycles, structures, and processes that interact" and (4.6) "The student knows that change can create recognizable patterns" are repeated in Objectives 2, 3, and 4. Systems in the life sciences might be examined in the study of ecosystems or the human body; in the physical sciences, in bicycles or circuits; and in the earth/space sciences, in the solar system or watersheds.

Highlights of Objective 2

- Students should understand the difference between inherited traits and learned behavior. For example, the color of a dog's fur is an inherited trait, but retrieving a ball on command is a learned behavior.
- Students need to understand how adaptations (5.9)(A) affect the survival of a species. The concept of adaptation and survival is focused not at the level of the individual organism but at the species level. In order for a species to survive, individuals of that species must reproduce and pass on their genetic traits to future generations. Reproduction will be assessed in relation to the survival of a species, not as a human body process.

- Organisms do not consciously adapt to their environment. Instead, genetic variations allow for adaptations that may or may not be an advantage when changes in the environment put selective pressure on a species.

- Students must demonstrate knowledge of interactions within ecosystems. This includes understanding what animals and plants need, how they meet these needs, and how meeting these needs changes the environment. Students need to be aware that in a food chain or food web, the arrows are used to indicate energy flow. Therefore, each arrow points to the organism that is taking in, or ingesting, the energy.

- The term *unique niche* (5.9)(B) refers to the idea that organisms possess characteristics allowing them to play specialized roles in their ecosystem. For example, a rabbit is a primary consumer (herbivore) in a habitat where grasses are the producers (autotrophs). A coyote, a secondary consumer (carnivore), preys on the rabbit in this habitat. The rabbit is considered both a consumer and prey. This is one of the characteristics that defines the rabbit's niche in this habitat.

Objective 2 Sample Items

6 Coyotes learn some of their behaviors as they move around in their environment. Which behavior is most likely learned?

A Running

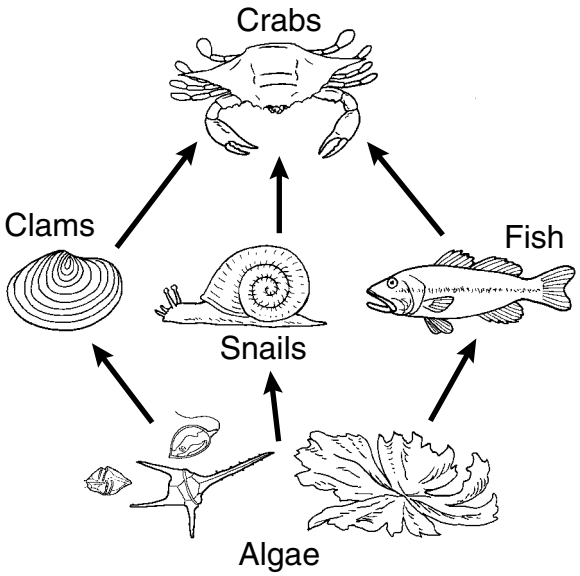
B Drinking water

C* Avoiding cacti

D Sleeping

(5.10)(B)

This item represents one way to approach the ideas of learned behaviors and inherited traits. Students will not be expected to be familiar with all organisms. These items require students to apply what they have learned to new situations.



7 According to the food web shown, a decrease in the number of clams would probably result in —

A a decrease in the amount of algae

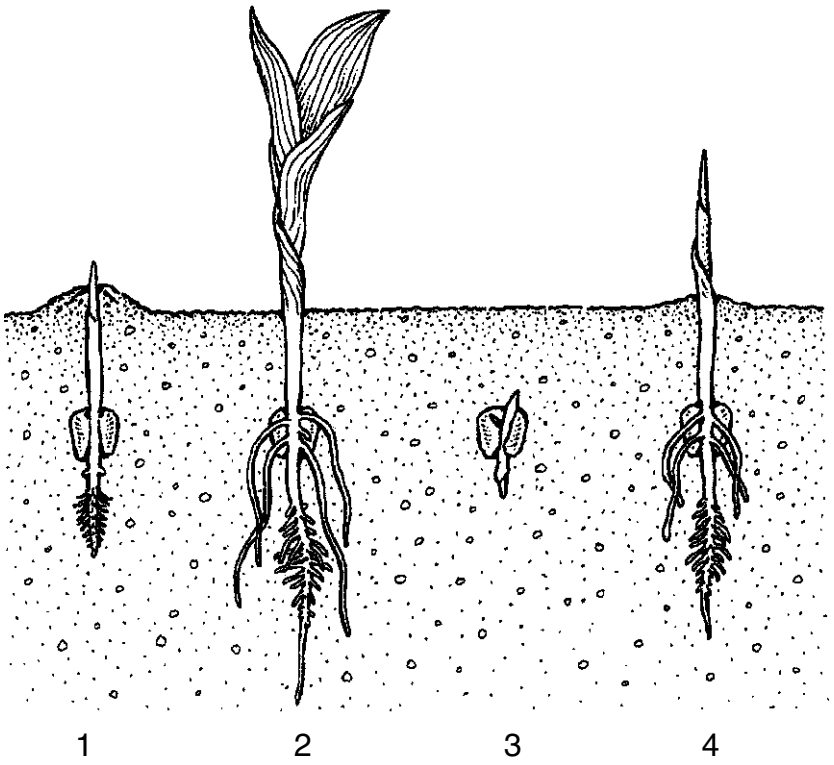
B an increased number of crabs

C fish and snails eating crabs

D* crabs eating more snails

(2.9)(B)

This is an example of a grade 2 student expectation written with the depth and complexity of a grade 5 item. In this item, students must understand the relationships between organisms in a food web and make conclusions about how those organisms will be affected when changes occur in the food web.



8 Which of these shows the correct order of corn plant development?

A 4, 1, 3, 2

B 3, 4, 1, 2

C* 3, 1, 4, 2

D 4, 3, 2, 1

(4.6)(A)
This item is an example of "patterns of change" in living organisms.

egg → larva → pupa → adult

9 Which animal goes through the stages of metamorphosis shown above?

A* Beetle

B Frog

C Bird

D Snake

(5.6)(C)
This item requires that students compare the life cycles of organisms. Though similar to (4.6)(A), which is to identify "patterns of change," this student expectation requires students to be able to describe and compare lifecycles of different organisms. Students would not need to have studied specific animals since the answer choices are general.

10 The mole is an animal that digs tunnels. Which of the following characteristics would **NOT** be an advantage to a mole?

A Sharp claws

B* Large ears

C Small eyes

D Strong legs

(5.9)(B)
Students will need to consider the needs of organisms in various environments and make inferences about the behavioral and physical adaptations that organisms may have that allow the organisms to survive in their environment. Notice that the description of moles is given in the stem of the item. Therefore, students do not need to have studied moles, but they need to be able to apply their knowledge to a new idea.

At grade 5, items that ask students to find the exception to a rule or situation may use **NOT**, and **NOT** will always be capitalized and boldface.

Objective 3: The student will demonstrate an understanding of the physical sciences.

The physical sciences explain the overall structure and the basic physical principles of the universe, with an emphasis on matter, energy, motion, and forces. Forces cause matter to undergo changes. These changes, such as when sugar dissolves in water or when electricity flows through a wire, involve energy and energy transformations. A basic understanding of the physical sciences learned in the elementary grades provides the foundation for a deeper comprehension of energy, machines, properties of matter, and chemical reactions assessed on the grades 8, 10, and exit level TAKS.

(3.6) **Science concepts.** The student knows that forces cause change. The student is expected to

(A) measure and record changes in the position and direction of the motion of an object to which a force such as a push or pull has been applied.

(4.6) **Science concepts.** The student knows that change can create recognizable patterns. The student is expected to

(A) identify patterns of change such as in weather, metamorphosis, and objects in the sky.

(5.5) **Science concepts.** The student knows that a system is a collection of cycles, structures, and processes that interact. The student is expected to

(A) describe some cycles, structures, and processes that are found in a simple system; and

(B) describe some interactions that occur in a simple system.

(3.7, 4.7, 5.7) **Science concepts.** The student knows that matter has physical properties. The student is expected to

(A) classify matter based on its physical properties including magnetism, physical state, and the ability to conduct or insulate heat, electricity, and sound (5.7);

(B) demonstrate that some mixtures maintain the physical properties of their ingredients (5.7);

(C) identify changes that can occur in the physical properties of the ingredients of solutions such as dissolving sugar in water (5.7); and

(D) observe and measure characteristic properties of substances that remain constant such as boiling points and melting points (5.7).

(5.8) **Science concepts.** The student knows that energy occurs in many forms. The student is expected to

(A) differentiate among forms of energy including light, heat, electrical, and solar energy;

(B) identify and demonstrate everyday examples of how light is reflected, such as from tinted windows, and refracted, such as in cameras, telescopes, and eyeglasses;

(C) demonstrate that electricity can flow in a circuit and can produce heat, light, sound, and magnetic effects; and

(D) verify that vibrating an object can produce sound.

Highlights of Objective 3

- Students should have the opportunity to experiment with different forms of energy in the classroom, laboratory, and field. At the elementary level, students should be able to identify different forms of energy such as light, electricity, and heat. Students should also have hands-on experience with magnets. They should recognize that a circuit is a system with many parts.

- The concepts of light and sound tested at Grade 5 are based on students' having hands-on experiences that explore reflection, refraction, and vibration. These investigations are the basis for understanding frequency, pitch, wavelength, and amplitude, which will be studied at the middle and high school levels.

- Students should be able to classify matter according to some of its physical properties. Students should experiment with different types of mixtures, such as liquids with liquids, liquids with solids, and solids with solids. It is important for students to realize that solutions are a type of mixture. Students should also be aware that the parts of mixtures do not chemically change and that mixtures can be physically separated into their original components.

- Students must recognize that change does not happen by itself. Some type of force must be present to cause change. For example, when a force is applied to a guitar string, the resulting vibration produces sound.

Objective 3 Sample Items

11 A student places a sugar cube in a beaker of water. What change will occur?

A The sugar cube will not change.

B More water will be formed.

C* The sugar cube will become smaller.

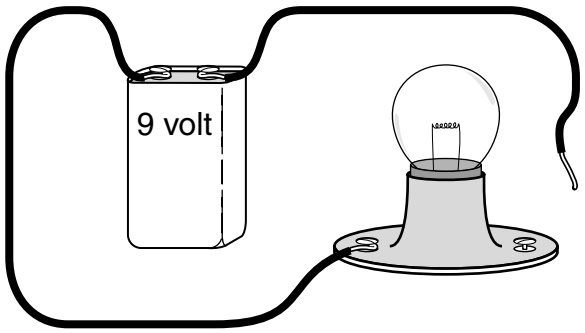
D The water will form crystals.

(5.7)(C)

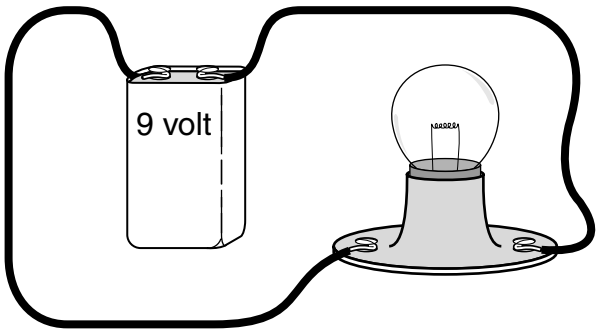
This item requires students to use their knowledge of solutions and to understand that as solids dissolve, they do not "disappear" but break apart into individual particles. In this item students need to understand that as the sugar dissolves, the sugar particles move into the water and therefore the remaining sugar cube becomes smaller.

12 Which circuit will cause the lightbulb to glow?

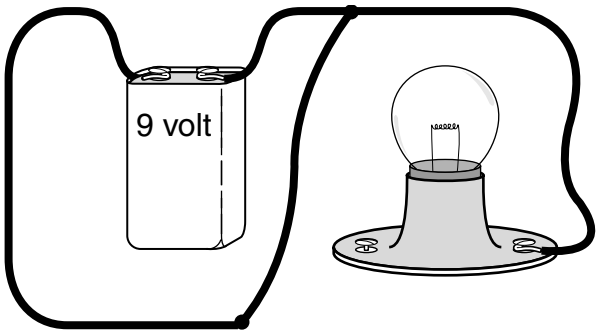
A



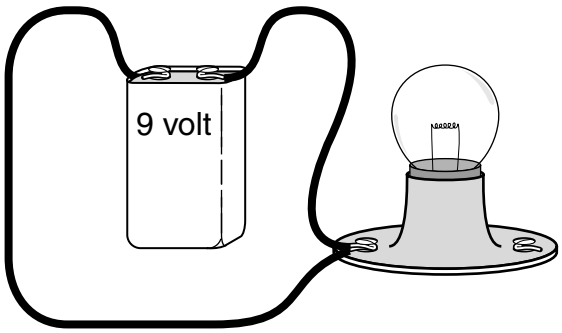
B*



C



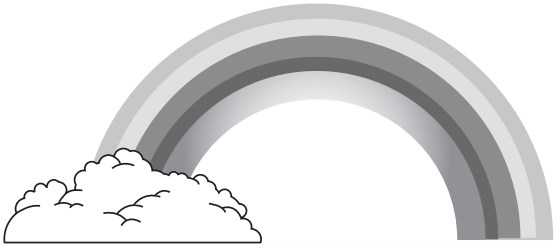
D



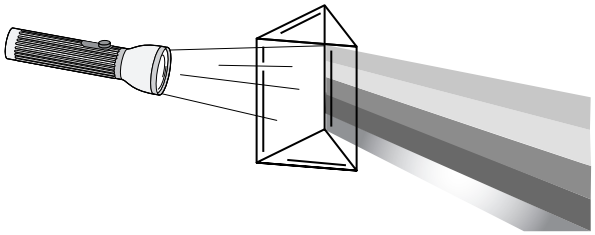
(5.8)(C)
This item requires students to apply their laboratory experiences with the construction of simple electrical circuits. Using their observation skills, students should be able to recognize the illustration that represents a complete circuit.

13 All the following are examples of light being refracted **EXCEPT** —

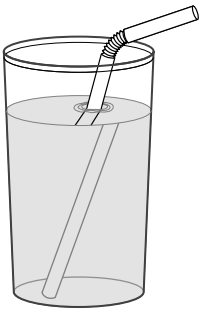
A



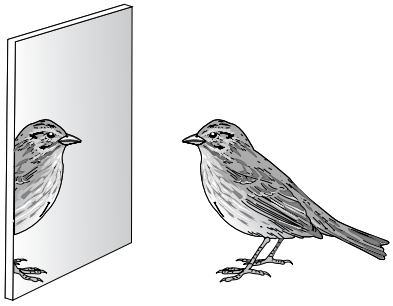
B



C



D*



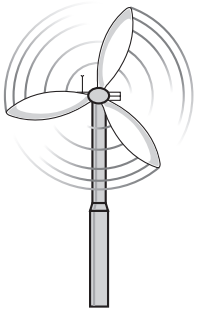
(5.8)(B)

This item reinforces the importance of students doing science. Students might have a difficult time remembering the difference between reflection and refraction if they never have had actual experience doing activities that explore the differences. At grade 5, items that ask students to find the exception to a rule or situation may use **EXCEPT**, and **EXCEPT** will always be capitalized, boldface, and at the end of the stem.

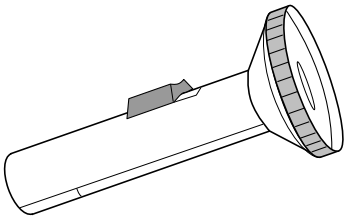
14 Which of these is made to change electrical energy to heat energy?

A

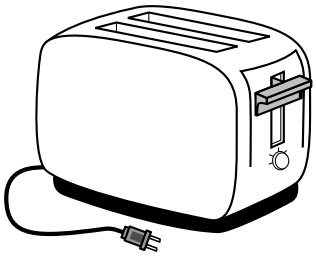
B



C



D*



(5.8)(C)
Students must know the different forms of energy and recognize situations in which basic energy transformations occur.

Masses of Objects

Bird feather	Rubber ball	Block of cement	Block of wood
0.01 g	1 g	10 g	14 g

15 Which object requires the most force to move a distance of 1 meter?

A Bird feather

B Rubber ball

C Block of cement

D* Block of wood

(3.6)(A)
This item shows that students must have a very basic understanding of acceleration. This lays the foundation for a deeper understanding of Newton's second law, which will be taught in middle and high school.

Objective 4: The student will demonstrate an understanding of the earth sciences.

A basic knowledge of the earth/space sciences allows students to understand how Earth's physical features are shaped by forces and are continually changing. These changes can affect the availability of resources, many of which are limited. The earth/space sciences lend themselves to the study of many types of systems, cycles, and change. Through the study of the physical features of Earth, the moon, and the sun, students begin to understand the universe as a dynamic system.

Earth/space science concepts learned at the elementary grades and developed in sixth through eighth grades provide the connection for the earth/space science integrations found in Biology and IPC, which will be assessed at grades 8, 10, and exit level.

(3.6) **Science concepts.** The student knows that forces cause change. The student is expected to

(B) identify that the surface of the Earth can be changed by forces such as earthquakes and glaciers.

(4.6) **Science concepts.** The student knows that change can create recognizable patterns. The student is expected to

(A) identify patterns of change such as in weather, metamorphosis, and objects in the sky.

(5.5) **Science concepts.** The student knows that a system is a collection of cycles, structures, and processes that interact. The student is expected to

(A) describe some cycles, structures, and processes that are found in a simple system; and

(B) describe some interactions that occur in a simple system.

(5.6) **Science concepts.** The student knows that some change occurs in cycles. The student is expected to

(A) identify events and describe changes that occur on a regular basis such as in daily, weekly, lunar, and seasonal cycles; and

(B) identify the significance of the water, carbon, and nitrogen cycles.

(4.10, 5.11) **Science concepts.** The student knows that certain past events affect present and future events. The student is expected to

(A) identify and observe actions that require time for changes to be measurable, including growth, erosion, dissolving, weathering, and flow (5.11);

(B) draw conclusions about "what happened before" using data such as from tree-growth rings and sedimentary rock sequences (5.11); and

(C) identify past events that led to the formation of the Earth's renewable, non-renewable, and inexhaustible resources (5.11).

(3.11, 4.11, 5.12) **Science concepts.** The student knows that the natural world includes earth materials and objects in the sky. The student is expected to

(A) identify and describe the importance of earth materials including rocks, soil, water, and gases of the atmosphere in the local area and classify them as renewable, nonrenewable, or inexhaustible resources (3.11);

(C) identify the planets in our solar system and their position in relation to the Sun (3.11);

(D) describe the characteristics of the Sun (3.11);

(A) test properties of soils including texture, capacity to retain water, and ability to support life (4.11);

(B) summarize the effects of the oceans on land (4.11);

(C) identify the Sun as the major source of energy for the Earth and understand its role in the growth of plants, in the creation of winds, and in the water cycle (4.11);

(A) interpret how land forms are the result of a combination of constructive and destructive forces such as deposition of sediment and weathering (5.12); and

(C) identify the physical characteristics of the Earth and compare them to the physical characteristics of the moon (5.12).

Highlights of Objective 4

- Students must understand the significance of the nitrogen, water, and carbon cycles in relation to animals, plants, and ecosystems. For example, carbon dioxide is taken up by plants to be converted into sugars through photosynthesis. Some animals eat the plants and use the sugar for energy. This example is only one way to approach this student expectation. Items will not include specific details about the carbon and nitrogen cycles.

- Students will identify and describe properties of earth materials such as soil, rocks, water, and atmospheric gases. Items will be based on classroom, laboratory, and field experiences that allow students to investigate and test properties of earth materials.

- Students must be familiar with renewable, nonrenewable, and inexhaustible resources. Lumber, a type of renewable resource, can be replaced in a relatively short period of time. Resources that can form or accumulate over a long time span, such as fossil fuels, are considered nonrenewable. Solar energy, which is so vast that it cannot be used up by human activities, is considered an inexhaustible resource.

- Students will be expected to be familiar with physical characteristics of Earth and the moon, but they will not always be expected to compare them.

- Examples of the "flow" mentioned in (5.11)(A) might include materials such as mud, lava, ice, or water.

- The TAKS science test will use the nine-planet system with the planets in their relative orbital positions from the sun.

- "Objects in the sky," listed in (4.6)(A), are defined as celestial bodies, such as planets, comets, and stars, or as weather phenomena, such as clouds or lightning.

Objective 4 Sample Items

16 Plants take in carbon dioxide gas and use it to make sugars. Through this process they release oxygen, which animals need. Which of the following activities could decrease the amount of oxygen released into the air?

A Making sure trees are planted with every new house built

B Encouraging cities to plan for more parks

C* Paving more land for roads and parking lots

D Better controls for air and water pollution

(5.6)(B)
This item requires students to have a basic understanding of the carbon cycle and to examine the relationship between plants and animals. Students should be familiar with the general interactions of the carbon cycle within the ecosystem and the effects of human activities on this cycle.

17 Most canyons are the result of erosion caused by —

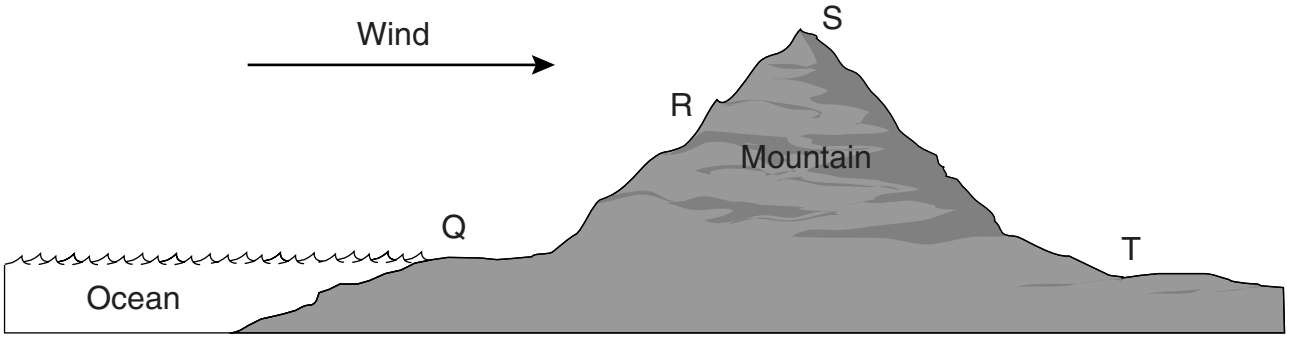
A* a river

B a volcano

C a hurricane

D an earthquake

(5.12)(A)
Students must know about landforms and what causes them.



18 The picture shows an ocean near a mountain range. When comparing location Q to location T, location T will usually have —

A brighter sunlight

B stronger winds

C more snow

D* less rain

(5.5)(A)
This item tests students' knowledge on a part of the water cycle and how changes can happen within this system.

Planets That Can Be Seen Without a Telescope

Planet	Moons	Average Distance from Sun (km)	Length of Year (Earth days)
Mercury	0	58,000,000	87
Venus	0	108,000,000	224
Earth	1	150,000,000	365
Mars	2	228,000,000	686
Jupiter	16	778,000,000	4,328
Saturn	18	1,427,000,000	10,775

19 Which planet has a year with a length closest to the length of a year on Earth?

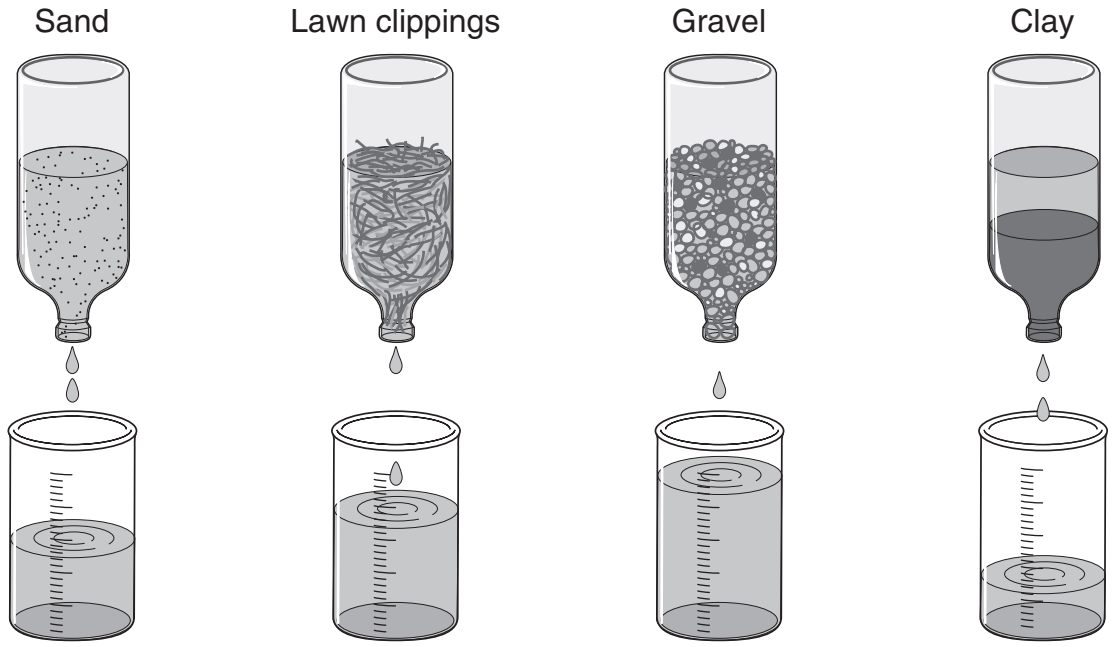
A Mercury

B* Venus

C Mars

D Jupiter

(3.11)(C)
This item requires students to read data from a chart, analyze and compare the data, and then make a conclusion.



20 The pictures show a method used to collect data in an investigation. Different kinds of materials were mixed with 100 grams of garden soil. An equal amount of water was added to each mixture. Which of these was this investigation designed to answer?

A How well each material mixes with garden soil

B* How well each mixture holds water

C How well each material supports plants

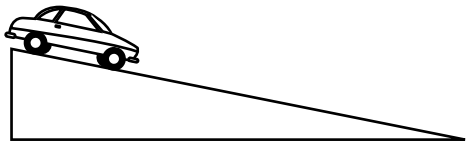
D How well each mixture keeps its texture when wet

(4.11)(A)

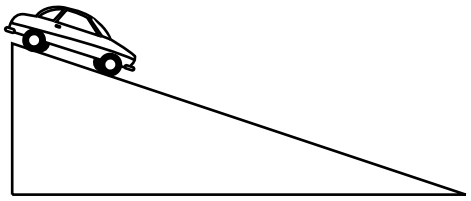
Students should have the opportunity to perform simple laboratory investigations. This item requires students to determine which property of soil materials is tested.

Cluster Example

Use the information below and your knowledge of science to help you answer questions 21–22.



Ramp 1



Ramp 2

Students placed two identical toy cars on these wooden ramps. The students let the cars roll down the ramps.

21 This experiment most likely tests the hypothesis that —

- **A** ramps made of wood make cars roll faster
- **B*** the height of the ramp affects the speed of the car
- **C** the speed of the car is determined by tire size
- **D** plastic cars travel faster than metal cars

22 What causes these cars to move down the ramps?

- **A** Electricity
- **B*** A force that pulls
- **C** Magnets
- **D** A force that lifts

(5.2)(A) and (3.6)(A)
This cluster illustrates the importance of lab work in the elementary science classroom. Students must be familiar with manipulating variables—in this case, how different heights of ramps affect speed. Students should be able to describe gravity as a force that can cause motion.

Note: This cluster consists of items from Objective 1 and Objective 3.

Appendix: Science Educator Resources

Texas Education Agency (TEA) Websites

TEA website: www.tea.state.tx.us
Graduation Requirements for Science: www.tea.state.tx.us/curriculum/side1.doc
Certification Requirements and PD Provider Number: www.sbec.state.tx.us

Resources for Teaching Science

Texas Science Center at Region IV: www.texassciencecenter.org
Science Safety: www.tenet.edu/teks/science/stacks/safety/safetymain.html
Texas Regional Collaboratives for Excellence in Science Teaching: http://regcol.edb.utexas.edu
Charles A. Dana Center: www.tenet.edu/teks/science
Benchmarks for Science Literacy: www.project2061.org/tools/benchol/bolintro.htm
Science for All Americans: www.project2061.org/tools/sfaaol/sfaatoc.htm
National Science Education Standards: www.nap.edu/readingroom/books/nses/html/

Resources from Organizations

Science Teachers Association of Texas: www.statweb.org
National Science Teachers Association: www.nsta.org
National Association of Biology Teachers: www.nabt.org
American Association of Physics Teachers: www.aapt.org
American Chemical Society: www.acs.org
National Earth Science Teachers Association: www.nestanet.org

If you need any help in the area of science curriculum or assessment, please feel free to contact:

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