

Using Tools to Explore Matter

Introduction

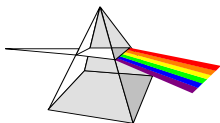
Bridging II TAKS Using Fundamental Learning Experiences in Science Logos, Symbols, and Icons



Texas Assessment of Knowledge and Skills: identifies information taken for the Texas Education Agency's state assessment program



Promoting Academic Success in Science: identifies products and services of the Texas Science Center, Houston, Texas



Module 1: *Light and Optical Systems.* identifies the first module of the Bridging II TAKS series



Module 2: *Using Tools to Explore Matter.* identifies the second module of the Bridging II TAKS series

ENGAGE

EXPLORE

EXPLAIN

ELABORATE

EVALUATE

5-E Instructional Model: placed along sides of instructional materials to quickly identify stage of learning experience; increasing relative lengths parallel the increasing conceptual understanding of learner

Using Tools to Explore Matter

Introduction

Bridging II TAKS

Using Fundamental Learning Experiences in Science

Logos, Symbols, and Icons

**SAFETY
FIRST
ALERT**

Safety First Alert: identifies potential risks and appropriate safety precautions to follow before, during, and/or after instructional time

Targeted Texas Essential Knowledge & Skills

Icons used throughout learning experiences identify Science TEKS addressed and the interdisciplinary connections to specific TEKS of other content areas



Science



Mathematics



English Language Arts



Social Studies



Art



Music



Theatre



Physical Education

Suggested Classroom Settings

Icons used throughout learning experiences encourage the use of a variety of appropriate learner groupings



Individual learner



Small group interaction



Whole group interaction

Using Tools to Explore Matter

Introduction



TAKS Information Booklet

Elementary Science-Grade 5

To download entire document:

www.tea.state.tx.us/student.assessment/taks/booklets/science/gr5.pdf

What types of equipment may be referenced on the TAKS Elementary Science test? (p. 7)

Although students will not actually use science equipment during the test, they will be expected to have experience using all of the equipment and supplies found in student expectation **4(A)** in first through fifth grades. This list includes calculators, microscopes, cameras, sound recorders, computers, hand lenses, rulers, thermometers, compasses, balances, hot plates, meter sticks, timing devices, magnets, collecting nets, and safety goggles.

Predict: At which grade level do the Texas Essential Knowledge and Skills statements specifically introduce the use of these 16 tools?

Tools	Prediction	Actual
1. balances		
2. calculators		
3. cameras		
4. collecting nets		
5. compasses		
6. computers		
7. hand lenses		
8. hot plates		
9. magnets		
10. meter sticks		
11. microscopes		
12. rulers		
13. safety goggles		
14. sound recorders		
15. thermometers		
16. timing devices		

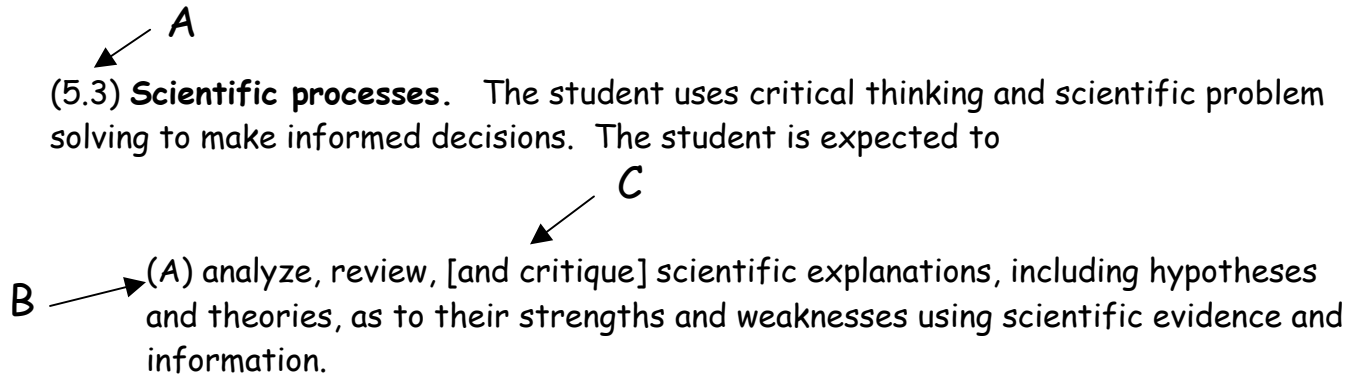
Using Tools to Explore Matter**Introduction**

Collect Data: Place a checkmark under the appropriate columns to indicate which tools are listed in **TEKS 4(A)** of each grade level.

Tools	Grade K	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
1. balances	✓	✓	✓	✓	✓	✓
2. bowls						
3. calculators						
4. cameras						
5. clocks						
6. collecting nets						
7. compasses						
8. computers						
9. cups						
10. hand lenses						
11. hot plates						
12. magnets						
13. measuring cups						
14. meter sticks						
15. microscopes						
16. rulers						
17. safety goggles						
18. sound recorders						
19. thermometers						
20. timing devices						

A Key to Understanding the TEKS Included on TAKS Elementary Science, p. 8

Example from Objective 1



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]

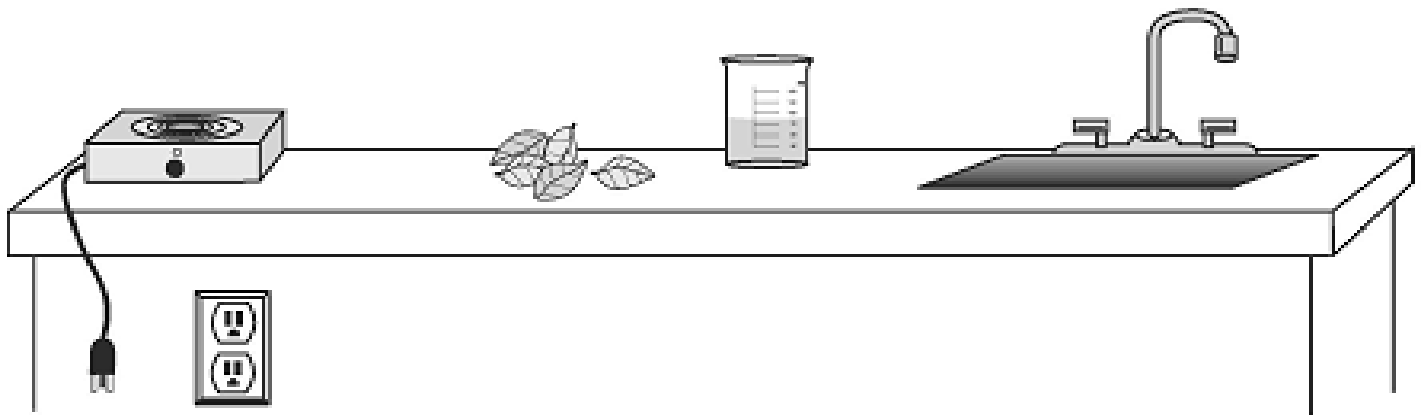
The student expectation has been presented in its entirety for two reasons: to clarify the link to the curriculum and to provide background information for test items. However, bracketed text will not be specifically tested on the TAKS.

Using Tools to Explore Matter**Introduction**

Read the following TEKS statement taken from Objective 1 of the Elementary Science TAKS. Compare the statement with the sample item below. Discuss with your group the implications of the use of bracketed items.

(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.



Sample Item:

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.

TEKS Student Expectations—Important Vocabulary, p. 9-10

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

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 use them. 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. 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.

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.



Texas Assessment of Knowledge and Skills Elementary Science—Grade 5, p. 11-14

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 fifth, tenth, and eleventh grades. 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, and measuring cups.

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.

(5.2) Scientific processes. The student uses scientific 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.

Using Tools to Explore Matter**Introduction**

(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.

(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.

Highlights of Objective 1

- *Texas Safety Standards* should be referenced as students learn about and use safe practices in the classroom, laboratory, and field. To download the document visit: <http://www.tenet.edu/teks/science/safety/index.html> (Safety Standards) http://www.tenet.edu/teks/science/safety/facilities_manual.html (Facility Manual)
- Scientists use many methods in their research. Students should learn a variety of methods to solve problems and make sense of the world.
- Students should be able to use evidence to evaluate the strengths and weaknesses of a scientific explanation of a given phenomenon.
- 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 balances, volumes from graduated cylinders, and temperatures from thermometers. They may also be asked to determine the lengths of objects using a 20-centimeter paper ruler provided as part of the test materials. Since the ends of rulers may be damaged, students should be aware that it is important not to start at the end of the ruler when measuring.

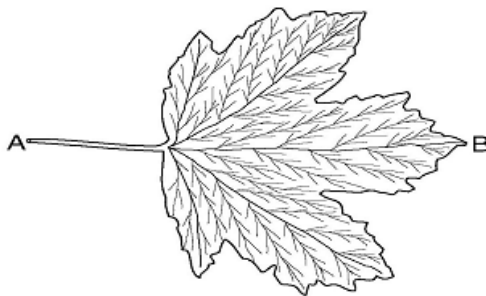
Using Tools to Explore Matter

Introduction

- 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.

Sample Item:

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.



			.
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 a centimeter ruler 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 based on 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.

NOTE: This three-column grid will be the only type of grid for Elementary Science—Grade 5 TAKS. 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.



Texas Assessment of Knowledge and Skills Elementary Science—Grade 5, p. 21-24

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, whether they occur 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 developed in sixth through eighth grades and assessed on the Grade 10 and the Grade 11 Exit Level TAKS.

(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.

(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;
- (B) demonstrate that some mixtures maintain the physical properties of their ingredients;
- (C) identify changes that can occur in the physical properties of the ingredients of solutions such as dissolving sugar in water; and
- (D) observe and measure characteristic properties of substances that remain constant such as boiling points and melting points.

(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.

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.

(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.

Highlights of Objective 3

- Students should have the opportunity to experiment with different forms of energy (light, electrical, solar, and heat) in the classroom, laboratory, and field. They should recognize that a circuit is a system with many parts. The concepts of light and sound tested at fifth grade 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 liquid-liquid, liquid-solid, and solid-solid. 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.

Sample Item:

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 that the sugar cube therefore becomes smaller.