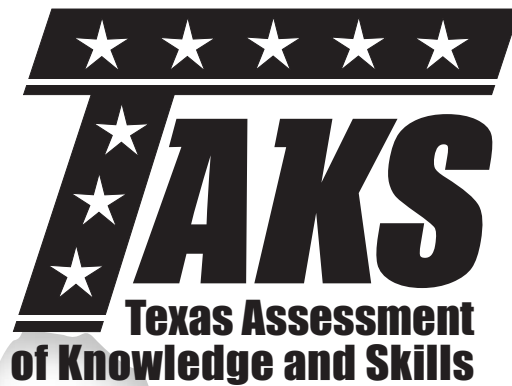


August 2005



Information Booklet

Middle School Science Grade 8

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 TAKS information booklet. We hope this 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 received from more than 57,000 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.

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.

MIDDLE SCHOOL SCIENCE TAKS

The test development process for middle school science assessment began in summer 2003. A committee of TEA Student Assessment and Curriculum staff developed a tentative draft of test objectives and student expectations from the TEKS that might best represent the middle school science curriculum. This draft was presented to hundreds of Texas educators from across the state who gave recommendations for additions and deletions. These recommendations were then incorporated into an educator survey, which was sent to middle schools across the state. This survey 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 their eighth grade school year. The survey was also made available online. Based on input received from middle school survey responses, a final draft of the objectives and student expectations was developed.

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. 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, 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 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 is based on eligible science TEKS from grades 2–5. The middle school science test is based on selected science TEKS from grades 6–8. The grade 10 and 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 Education Standards, Benchmarks for Science Literacy*, and *Science for All Americans*. These books are excellent resources for guidance in finding grade-appropriate strategies for teaching many science concepts. These nationally recognized documents may also help educators understand the depth and complexity of the TEKS.

How were the TEKS chosen to be on the grade 8 TAKS science test?

The middle school science TEKS knowledge and skills statements and student expectations eligible for assessment were determined to be appropriate for TAKS by Texas science educators. Student Assessment and Curriculum staff from TEA received input from approximately 500 educators at the Texas Science Education Leadership Association (TSELA) Conference and the 2004 Conference for the Advancement of Science Teaching (CAST). In addition, TEA used feedback from approximately 1,400 campus consensus surveys as well as from a middle school science educator committee to finalize the objectives and TEKS student expectations eligible for assessment of grade 8. Although some student expectations within the TEKS are not assessed, it is important that educators teach all 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 science test has four objectives, while 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 student expectation 8.9(A), “The student is expected to demonstrate that substances may react chemically to form new substances.” This concept will be assessed within the framework of the overriding knowledge and skills statement, which reads, “The student knows that substances have physical and chemical properties.”

Concepts may be “unbundled” within the knowledge and skills statement or the student expectation. That is, items may assess concepts individually and not necessarily in relation to one another within a student expectation. For instance, in Objective 5 (“The student will demonstrate an understanding of earth and space systems”) the knowledge and skills statement and student expectation (8.10)(B) states, “The student knows that complex interactions occur between matter and energy. The student is expected to describe interactions among solar, weather, and ocean systems.” However, a particular test item may address only the solar and weather system interactions. It may not include the role of ocean systems.

What are “unifying themes”?

All educators should work together to align the curriculum across all grade levels so that unifying themes 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.

The science TEKS contain unifying themes, or conceptual strands, that are developed across grade levels in a grade-appropriate progression. To ensure thorough teaching of the TEKS, educators should connect concepts throughout the grade levels and provide varied opportunities for students to understand 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 important for teachers to introduce students to science content in a variety of ways. It is also essential for teachers to help students make connections among the science disciplines by showing the natural integrations among the life, earth, and physical sciences. For example, when studying different soil types (earth science), students can also 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. The admission, review, and dismissal (ARD) committee can recommend that a student take the grade 5, 8, 10, or exit level science assessment, if appropriate. TAKS should be considered first when making assessment decisions for students receiving special education services. If the ARD committee determines that the TAKS science tests are not an appropriate assessment for a specific student, then the student must be assessed by a locally determined alternate assessment (LDAA). An LDAA can be a portfolio, a modified released test, a hands-on lab or field activity, or any other locally determined 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 knowledge and analysis of the given information. Cluster items will appear together on the 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 provide a numerical response appropriate for that item, such as a percentage, or to measure with precision and then determine an appropriate answer independently. Not all griddable items are computation based, and they may appear in any of the five objectives. When computation is involved, 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 seven-column grid will be the only type of grid for the Middle School Science—Grade 8 TAKS test.

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

The decimal on the grid defines the place values of the columns that precede and follow it. Students must record their answer in the columns for 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. Blank grid spaces before or after the answer may be gridded with zeros without affecting the student’s score.

How will the grade 8 TAKS science tests be administered?

Currently the grade 8 science test is administered through traditional paper-and-pencil testing. However, the state is exploring the use of online testing, which includes conducting comparability studies examining the online mode and the paper-and-pencil mode. Also being explored is the use of “innovative” item types administered online that include video clips, animations, and color graphics. Online testing, including innovative items, may be utilized in future test administrations. Should this occur, information about online testing will be provided via the TEA website.

Will any of the TAKS science tests be performance based?

The only direct performance testing 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. Although precise measurement is the direct performance-based requirement, many items are based on lab or field activities that students should have experienced. These lab and field experiences should include the use of lab and field equipment.

Remember that when the 20-centimeter paper ruler that accompanies the TAKS science test or any measurement item 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 Middle School Science—Grade 8 TAKS

Who will be required to take the Middle School Science—Grade 8 TAKS?

All eighth-grade students will be required to take the TAKS middle school science test unless determined 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 the *ARD Committee Decision-Making Process for the Texas Assessment Program* and *LPAC Decision-Making Process for the Texas Assessment Program*.

What TEKS will be included on the Middle School Science—Grade 8 TAKS?

The grade 8 TAKS is a comprehensive middle school assessment. Even though the test is given at eighth grade, it includes five objectives that cover science TEKS from grades 6, 7, and 8. A 50-item science test will provide an accurate snapshot of students' understanding of important science concepts taught at middle school. There is an emphasis on Objective 1, which is similar to the TAKS science tests at grade 5, grade 10, and exit level. Many items make connections across science disciplines: life, physical, and earth/space sciences. These items may integrate more than one science objective.

How should the TEKS be approached at the middle school level?

Students learn science by doing science. At the middle school level, science process skills and content can be learned through integrated activities and hands-on experiences. Students must have a thorough understanding of the background subject matter found in the TEKS at grades 6–8 and should know how science is relevant to their everyday lives. Test items are cognitively appropriate for middle school students and are designed to build on elementary concepts and provide scaffolding to high school concepts. Students will be tested on a deeper understanding of conceptual ideas than in the fifth grade TAKS test. Items will address student expectations in the context of knowledge and skills statements, which are broader themes that culminate at grade 8.

How important is middle school science education?

The grade 8 TAKS science test should serve as a significant indicator of students' science knowledge and skills at the eighth-grade level. In middle school 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. In addition, a mastery of these skills will be necessary for continued success in high school science.

What is the role of the untested TEKS in the middle school assessment?

Because of the constraints of a single statewide assessment, not all TEKS can be assessed. While some student expectations are not tested, all the TEKS are critical for students' overall understanding of science. For example, (7.11), "The student knows that the responses of organisms are caused by internal or external stimuli. The student is expected to (A) analyze changes in organisms such as a fever or vomiting that may result from internal stimuli; and (B) identify responses in organisms to external stimuli found in the environment such as the presence or absence of light," is not directly

tested, but students must understand this concept in order to successfully answer items testing (8.6), “The student knows that interdependence occurs among living systems. The student is expected to (A) describe interactions among systems in the human organism; (B) identify feedback mechanisms that maintain equilibrium of systems such as body temperature, turgor pressure, and chemical reactions; and (C) describe interactions within ecosystems.” The relationship between organisms that are composed of several systems maintaining homeostasis (equilibrium) and their role in the environment is not fully understood until eighth grade, when it is assessed in the middle school TAKS test. This concept is then more fully explored in high school through Biology (10), “The student knows that, at all levels of nature, living systems are found within other living systems, each with its own boundary and limits. The student is expected to (A) interpret the functions of systems in organisms including circulatory, digestive, nervous, endocrine, reproductive, integumentary, skeletal, respiratory, muscular, excretory, and immune.”

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 middle school science test?

Students will be expected to have experience using all of the tools and equipment commonly used in first through eighth grades. This includes beakers, test tubes, petri dishes, graduated cylinders, microscopes (dissecting and compound), safety goggles (splash-proof), spring scales, triple-beam balances, metersticks, hot plates, thermometers, models (such as topographic maps and globes), computers, computer probes (for temperature and pH), calculators, timing devices, weather instruments, telescopes, and field equipment such as binoculars, dip nets for collection, and water test kits.

Will students use calculators on the test?

Students will not use calculators on the middle school TAKS science test.

What is on the science chart?

The science chart has two sides (see pages 14–15). One side has a periodic table appropriate for middle school, and the other side has a list of commonly used formulas and a 20-centimeter ruler. This resource is provided so that students do not need to memorize this information. Even though these formulas may not be directly addressed in the TEKS, they are important for a complete understanding of many physics concepts, such as density, work, and force. Room temperature, boiling point, and freezing point values will be provided in items for which these values are needed.

**MIDDLE SCHOOL SCIENCE—GRADE 8
TAKS BLUEPRINT**

TAKS Objectives	Number of Items
Objective 1: Nature of Science	14
Objective 2: Living Systems and the Environment	12
Objective 3: Structures and Properties of Matter	6
Objective 4: Motion, Forces, and Energy	6
Objective 5: Earth and Space Systems	12
Total items on the actual test	50
Field-test items	10
Total items on each test form	60

The middle school science TAKS blueprint will remain the same from one testing cycle to the next.

A Key to Understanding the TEKS Included on Middle School Science—Grade 8 TAKS

Example from Objective 3

A → (6.7, 7.7, 8.9) **Science Concepts.** The student knows that substances have physical and chemical properties. The student is expected to

B → (B) interpret information on the periodic table to understand that [physical] properties are used to group elements (8.9).

D ←

C ←

KEY

A. Knowledge and Skills Statement

This broad statement describes what students should know and be able to do for Middle School Science—Grade 8. The number(s) preceding the statement identify the knowledge and skills statement; in the example above, “(6.7, 7.7, 8.9)” indicates that the knowledge and skills statement is the same for grades 6, 7, and 8. 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. (8.9)

The number in parentheses indicates the grade level at which the student expectation appears. In the example above, “(8.9)” shows that this student expectation has been taken directly from the grade 8 science TEKS. While the wording of this student expectation is specific to grade 8, similar student expectations also appear in grades 6 and 7 under this same knowledge and skills statement. Texas educators have determined that the student expectation listed best represents what students must know and be able to do with regard to the science concepts inherent in the knowledge and skills statement. However, it is important for teachers at grades 6 and 7 to teach the student expectation that corresponds to the one listed so that students have the foundation they need for grade 8 instruction.

D. [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 TAKS.

NOTE: The full TEKS curriculum can be found at 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.

Example from Middle School Science, Objective 4

(6.8, 7.8, 8.10) **Science concepts.** The student knows that complex interactions occur between matter and energy. The student is expected to

- (A) illustrate examples of potential and kinetic energy in everyday life such as objects at rest, movement of geologic faults, and falling water (7.8).

For this student expectation, students must understand that stored energy can become energy of motion in a variety of ways, such as in the common examples listed. Students should be familiar with these examples, some of which can be demonstrated 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.

Example from Middle School Science, Objective 2

(6.10, 7.9) **Science concepts.** The student knows the relationship between structure and function in living systems. The student is expected to

- (C) identify how structure complements function at different levels of organization including organs, organ systems, organisms, and populations (6.10).

This student expectation lists four terms that identify levels of organization. These levels, along with their relationship to one another, must be taught. Other levels, such as tissues (composed of cells) and communities, can be used as well as those listed, but students are required to understand the levels listed 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.

FORMULA CHART

Middle School Science

Grade 8

Work = force \times distance

$$W = Fd$$

Speed = $\frac{\text{distance}}{\text{time}}$

$$s = \frac{d}{t}$$

Force = mass \times acceleration

$$F = ma$$

Weight = mass \times acceleration due to gravity

$$\text{Weight} = mg$$

Density = $\frac{\text{mass}}{\text{volume}}$

$$D = \frac{m}{v}$$

Constants/Conversions

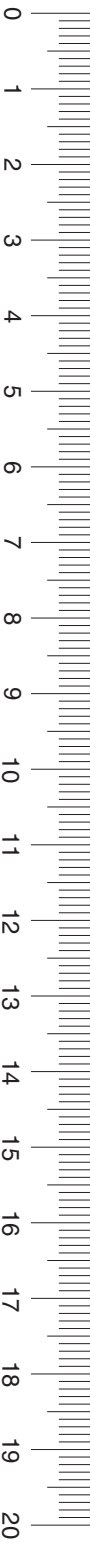
$$g = \text{acceleration due to gravity} = 9.8 \frac{\text{m}}{\text{s}^2}$$

$$\text{speed of light} = 3 \times 10^8 \frac{\text{m}}{\text{s}}$$

$$\text{speed of sound} = 343 \frac{\text{m}}{\text{s}} \text{ at sea level and } 20^\circ\text{C}$$

$$1 \text{ cm}^3 = 1 \text{ mL}$$

Centimeters



Middle School Science

Periodic Table of the Elements

Atomic number _____ 14
 Symbol _____ **Si**
 Atomic mass _____ 28.086
 Silicon _____ Name

Group 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

1 H 1.008 Hydrogen	2 He 4.0026 Helium																	
3 Li 6.941 Lithium	4 Be 9.012 Beryllium																	
11 Na 22.990 Sodium	12 Mg 24.305 Magnesium																	
19 K 39.098 Potassium	20 Ca 40.08 Calcium	3 Sc 44.956 Scandium	4 Ti 47.88 Titanium	5 V 50.942 Vanadium	6 Cr 51.996 Chromium	7 Mn 54.938 Manganese	8 Fe 55.847 Iron	9 Co 58.933 Cobalt	10 Ni 58.69 Nickel	11 Cu 63.546 Copper	12 Zn 65.39 Zinc	13 Al 26.982 Aluminum	14 Si 28.086 Silicon	15 P 30.974 Phosphorus	16 S 32.066 Sulfur	17 Cl 35.453 Chlorine	18 Ar 39.948 Argon	
37 Rb 85.468 Rubidium	38 Sr 87.62 Strontium	39 Y 88.906 Yttrium	40 Zr 91.224 Zirconium	41 Nb 92.906 Niobium	42 Mo 95.94 Molybdenum	43 Tc (98) Technetium	44 Ru 101.07 Ruthenium	45 Rh 102.906 Rhodium	46 Pd 106.42 Palladium	47 Ag 107.868 Silver	48 Cd 112.41 Cadmium	49 In 114.82 Indium	50 Sn 118.71 Tin	51 Sb 121.763 Antimony	52 Te 127.60 Tellurium	53 I 126.904 Iodine	54 Xe 131.29 Xenon	
55 Cs 132.905 Cesium	56 Ba 137.33 Barium	57 La 138.906 Lanthanum	72 Hf 178.49 Hafnium	73 Ta 180.948 Tantalum	74 W 183.84 Tungsten	75 Re 186.207 Rhenium	76 Os 190.23 Osmium	77 Ir 192.22 Iridium	78 Pt 195.08 Platinum	79 Au 196.967 Gold	80 Hg 200.59 Mercury	81 Tl 204.383 Thallium	82 Pb 207.2 Lead	83 Bi 208.980 Bismuth	84 Po (209) Polonium	85 At (210) Astatine	86 Rn (222) Radon	
87 Fr (223) Francium	88 Ra 226.025 Radium	89 Ac 227.028 Actinium	104 Rf (261) Rutherfordium	105 Db (262) Dubnium	106 Sg (263) Seaborgium	107 Bh (262) Bohrium	108 Hs (265) Hassium	109 Mt (266) Meitnerium	110 Ds (269) Darmstadtium									

Mass numbers in parentheses are those of the most stable or most common isotope.

Lanthanide Series		58 Ce 140.12 Cerium	59 Pr 140.908 Praseodymium	60 Nd 144.24 Neodymium	61 Pm (145) Promethium	62 Sm 150.36 Samarium	63 Eu 151.97 Europium	64 Gd 157.25 Gadolinium	65 Tb 158.925 Terbium	66 Dy 162.50 Dysprosium	67 Ho 164.930 Holmium	68 Er 167.26 Erbium	69 Tm 168.934 Thulium	70 Yb 173.04 Ytterbium	71 Lu 174.967 Lutetium
Actinide Series		90 Th 232.038 Thorium	91 Pa 231.036 Protactinium	92 U 238.029 Uranium	93 Np 237.048 Neptunium	94 Pu (244) Plutonium	95 Am (243) Americium	96 Cm (247) Curium	97 Bk (247) Berkelium	98 Cf (251) Californium	99 Es (252) Einsteinium	100 Fm (257) Fermium	101 Md (258) Mendelevium	102 No (259) Nobelium	103 Lr (262) Lawrencium

TEXAS ASSESSMENT OF KNOWLEDGE AND SKILLS

MIDDLE SCHOOL SCIENCE—GRADE 8

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

Objective 1 is focused on the study of science as an intellectual and social endeavor that helps students learn how the world works. The nature of science is at the heart of all sciences, K–16. However, 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 (8.2)(B) states that students are expected to “collect data by observing and measuring.” This same scientific process is included at all grade levels. Throughout the year, teachers should give students the opportunity to work in lab and field settings that allow students to discover the nature of science and learn scientific processes firsthand.

Activities related to the TEKS listed under Objective 1 should develop students’ critical-thinking skills and problem-solving abilities, which 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.

(6.1, 7.1, 8.1) **Scientific processes.** The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to

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

(6.2, 7.2, 8.2) **Scientific processes.** The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to

(A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting and using equipment and technology;

(B) collect data by observing and measuring;

(C) organize, analyze, evaluate, make inferences, and predict trends from direct and indirect evidence (7.2, 8.2);

(D) communicate valid conclusions; and

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

(6.3, 7.3, 8.3) **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 data [related to promotional materials] for products and services; and
- (C) represent the natural world using models and identify their limitations.

(6.4, 7.4, 8.4) **Scientific processes.** The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to

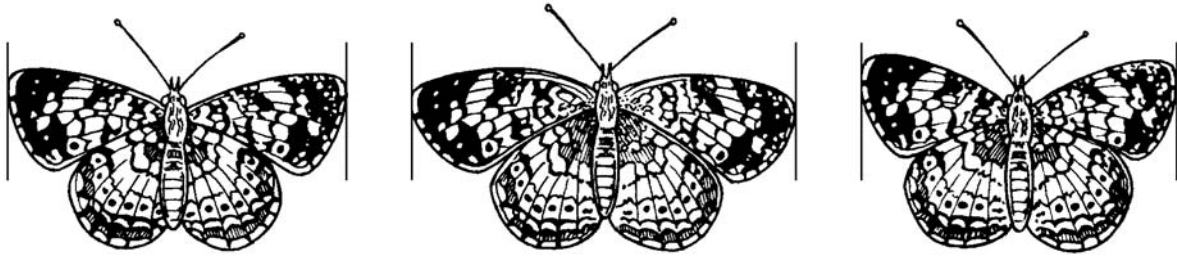
- (A) collect, record, and analyze information using tools including beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, hot plates, dissecting equipment, test tubes, safety goggles, spring scales, balances, microscopes, telescopes, thermometers, calculators, field equipment, computers, computer probes, water test kits, and timing devices (8.4); and
- (B) extrapolate from collected information to make predictions (8.4).

Highlights of Objective 1

- Scientists use many methods in their research, such as descriptive investigation, simple mathematical and engineering modeling and design, and controlled experiments. Students should learn a variety of methods 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 TEA's Office of Publications or accessed via www.tenet.edu/teks/science/safety/safety_manual.html, should be referenced as students learn about and use safe practices in the classroom, laboratory, and field. Teachers should refer to these safety standards when deciding whether to use open flames in the classroom.
- Students should be able to make inferences, to recognize meaningful data, to use evidence and data to evaluate the strengths and weaknesses of scientific explanations, and to analyze possible unexpected results from an investigation.
- Students should be able to interpret and evaluate graphs, charts, and maps. Maps may include topographic contour maps, in which each line on the map represents a change in elevation and differences in spacing between lines indicate relative steepness of slopes.
- The use of tools and equipment included in the middle school TEKS is part of this objective. Students will be required to recognize these tools and know how to properly use the most common ones. Students' ability to measure precisely, such as from a beaker, graduated cylinder, or thermometer, will be assessed.

- Students may be asked to apply basic science concepts to questions that assess scientific process skills, such as testing a hypothesis, predicting trends, and communicating conclusions.
- Models may be used to represent the natural world, such as Earth, the moon, or the sun. Students should understand that models have limitations and are not perfect representations because of their size and scope but that they are still useful for study.
- Students will be asked to extrapolate from collected information to make predictions and identify patterns. The intent is for students to use mathematical skills (including determining percentage, average, range, and frequency) in lab and field investigations, as in determining the average number of plants in a field sample.

Objective 1 Sample Items



- 1 What is the average wingspan of the three butterflies in centimeters?
- A 4.0 cm
 - B 4.2 cm
 - C* 4.6 cm
 - D 5.0 cm

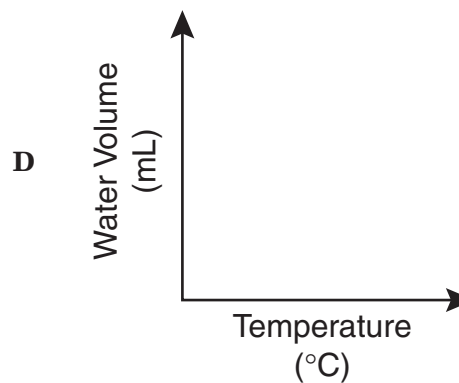
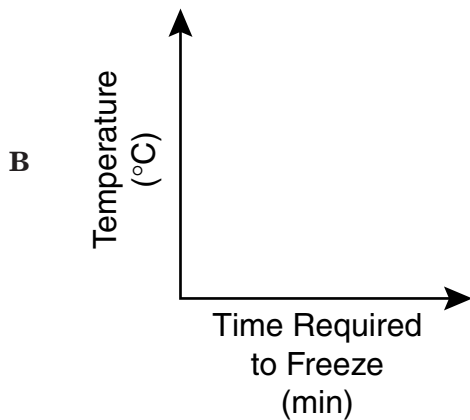
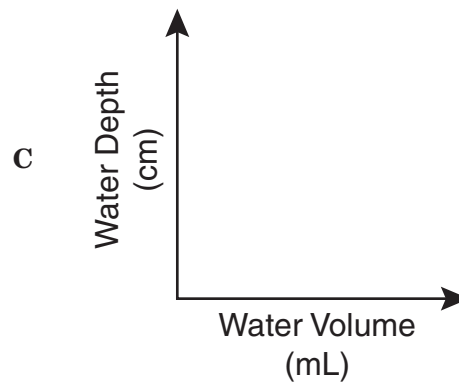
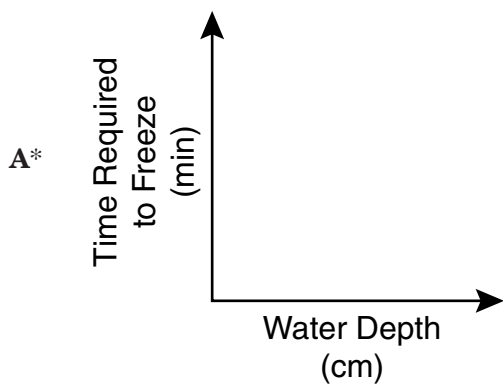
(8.2)(B)

Students have been asked to determine an average. Averaging the measurements of three different butterfly wingspans is an appropriate way to integrate a mathematical concept while testing a student's ability to use scientific inquiry methods during field and lab investigations. Determining percentage, range, average, and frequency are skills that will help students make predictions, extrapolate from collected information, and identify patterns. Students should also recognize that there may be variation (for instance, differences in wingspan) within a species.

NOTE: Additional sample items can be found in the cluster samples beginning on page 44.

Trial	Temperature (°C)	Water Volume (mL)	Water Depth (cm)	Time Required to Freeze (min)
1	20	50	5	?
2	20	50	10	?
3	20	50	15	?

2 Which of the following is best for graphing the variables for this investigation?



(8.2)(E)

This item allows the student an opportunity to identify the correct graph that fits the data given in the table. Students should begin to explore the relationship between two variables. This item measures a student's ability to organize and construct graphs that effectively show trends in data.

Temperature Readings

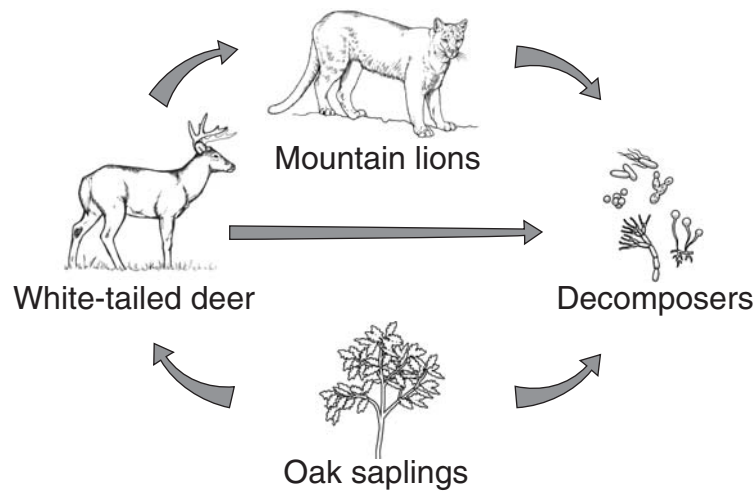
Day	Time	Temperature (°C)
Monday	7:00 A.M.	18
	7:00 P.M.	29
Tuesday	7:00 A.M.	19
	7:00 P.M.	28
Wednesday	7:00 A.M.	18
	7:00 P.M.	31

- 3 The table shows temperature readings taken from the same area over a three-day period. What is the average temperature difference in degrees Celsius between 7:00 A.M. and 7:00 P.M. for this three-day period? Record and bubble in your answer on the answer document.

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

(8.2)(E)

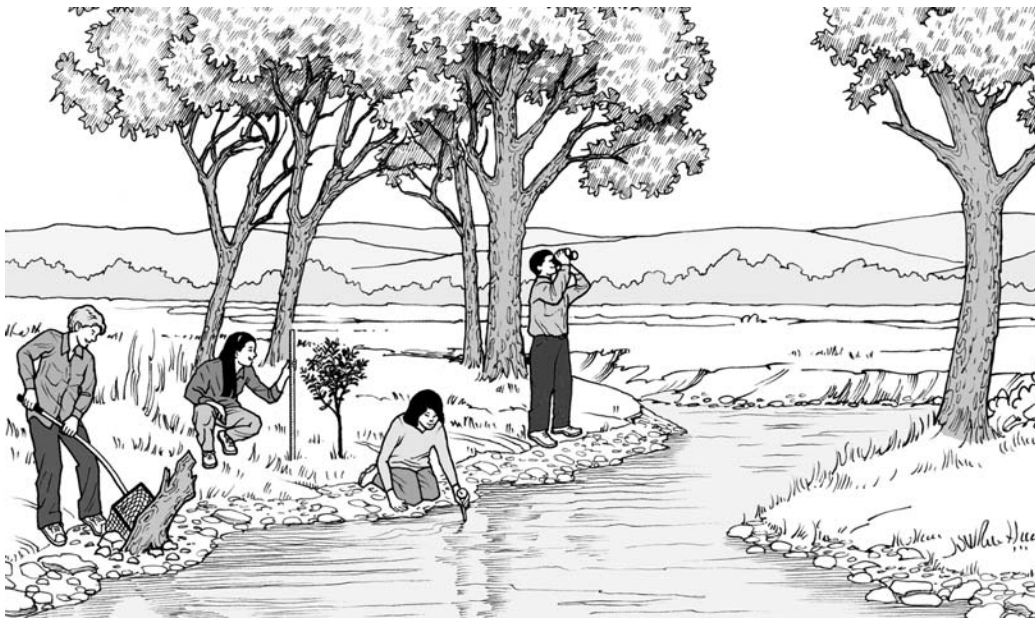
Griddable items are intended to give students the opportunity to work a problem and determine the correct answer. In this example, the numerical response is computation based. Other items may require making accurate measurements.



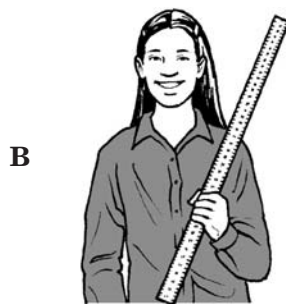
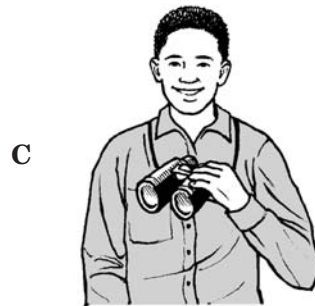
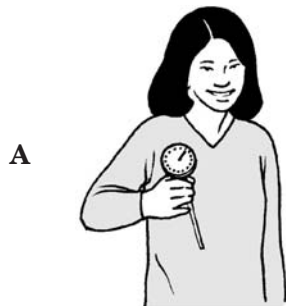
- 4 The food web represents the flow of energy in an ecosystem. The greatest limitation of this model is that —
- A water resources are not shown
 - B similar animals live in other ecosystems
 - C* many other types of organisms live in this ecosystem
 - D organisms are shown with no color

(8.3)(C)

This item addresses several student expectations, including concepts from ecology and energy. The specific student expectation for this item is to recognize the limitations of models in representing the natural world. Choice C is the correct answer because it identifies the greatest limitation of this model. Since food webs are complex, not all organisms can be included in one model. This item also illustrates how the flow of energy is represented by arrows in a food web. The energy from the organism that is consumed flows **to** the consumer. For example, the food energy from the deer flows to the mountain lions because mountain lions eat deer.



5 Students on a field trip were all given different equipment to collect data. Which student shown above is using the equipment improperly?



(8.4)(A)

This item measures a student’s ability to recognize equipment and know its correct use, reinforcing safe practices and scientific process skills. Items for this student expectation may include various settings for lab investigations, such as a classroom, a school hallway, or an outdoor area. Thermometers for air or water temperature may be used.

Objective 2: The student will demonstrate an understanding of living systems and the environment.

Objective 2 assesses a more thorough understanding of how living organisms function and interact within the environment. Elementary students are introduced to the basic needs of living organisms through traits and behaviors. In the middle school assessment, students will be expected to understand how these traits and behaviors work together to function as a living system. They must also know that living organisms form complex relationships with other living organisms and how organisms interconnect with living and nonliving components (such as energy from the sun) within the ecosystem. In addition, students are expected to understand the role of genetics and adaptation in evolutionary change.

- (6.5) **Science concepts.** The student knows that systems may combine with other systems to form a larger system. The student is expected to
 - (B) describe how the properties of a system are different from the properties of its parts.

- (6.10, 7.9) **Science concepts.** The student knows the relationship between structure and function in living systems. The student is expected to
 - (B) determine that all organisms are composed of cells that carry on functions to sustain life (6.10); and
 - (C) identify how structure complements function at different levels of organization including organs, organ systems, organisms, and populations (6.10).

- (6.8, 7.8, 8.10) **Science concepts.** The student knows that complex interactions occur between matter and energy. The student is expected to
 - (B) identify that radiant energy from the Sun is transferred into chemical energy through the process of photosynthesis (7.8).

- (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;
 - (C) describe how different environments support different varieties of organisms; and
 - (D) observe and describe the role of ecological succession in ecosystems.

(8.6) **Science concepts.** The student knows that interdependence occurs among living systems. The student is expected to

- (A) describe interactions among systems in the human organism;
- (B) identify feedback mechanisms that maintain equilibrium of systems such as body temperature, turgor pressure, and chemical reactions; and
- (C) describe interactions within ecosystems.

(6.11, 7.10, 8.11) **Science concepts.** The student knows that traits of species can change through generations and that the instructions for traits are contained in the genetic material of the organisms. The student is expected to

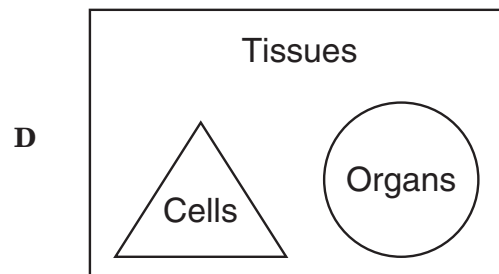
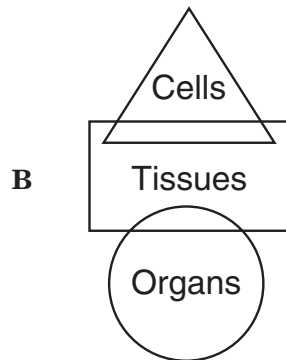
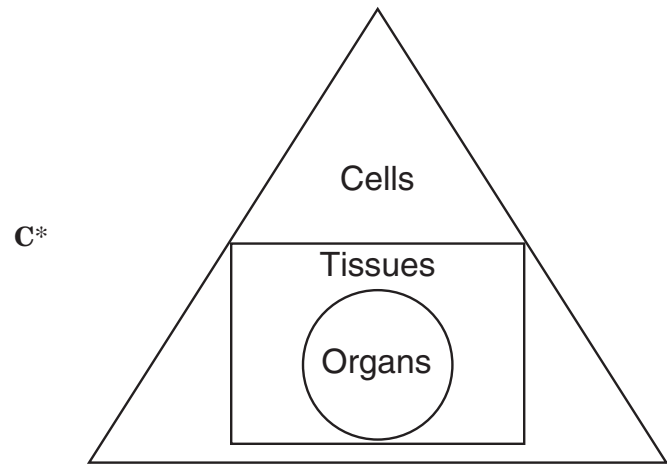
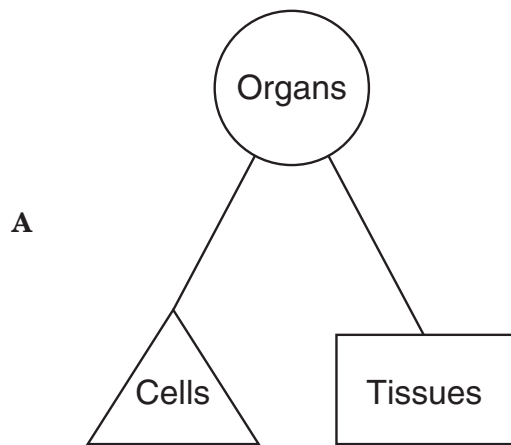
- (A) identify that change in environmental conditions can affect the survival of individuals and of species (8.11);
- (B) distinguish between inherited traits and other characteristics that result from interactions with the environment (8.11); and
- (C) make predictions about possible outcomes of various genetic combinations of inherited characteristics (8.11).

Highlights of Objective 2

- Food webs are part of student expectation (7.12) and may include examples from Texas or the southwestern United States in addition to global examples.
- Students need to understand that DNA contains all genetic information but do not need to know details of DNA’s molecular structure, which is taught in high school biology. Students should understand that the nucleus of the cell contains the chromosomes, which are composed of DNA, but that DNA can be inherited only through the sex cells (sperm and egg).
- Single-trait Punnett squares may be used, and students will be expected to predict genetic outcomes. For example, selective breeding, such as in purebred dogs, may be used.
- Students should know that human activity, both negative and positive, may result in environmental consequences (such as loss of habitat or overdevelopment in sensitive areas) but that there may be degrees of consequences. For example, environmental change does not necessarily lead to extinction of species—there may be a more gradual process that allows for recovery, as with the American bald eagle (see also “Highlights of Objective 5”).

Objective 2 Sample Items

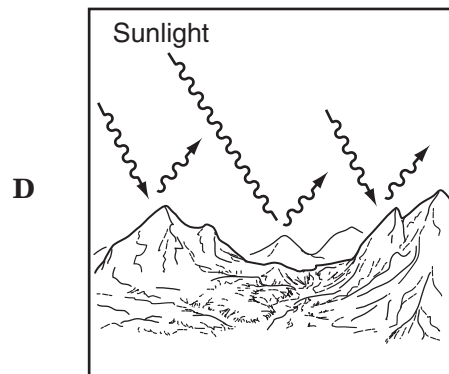
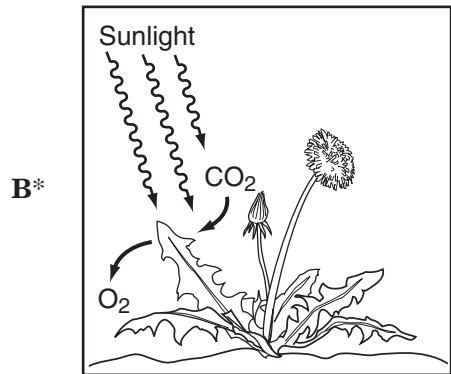
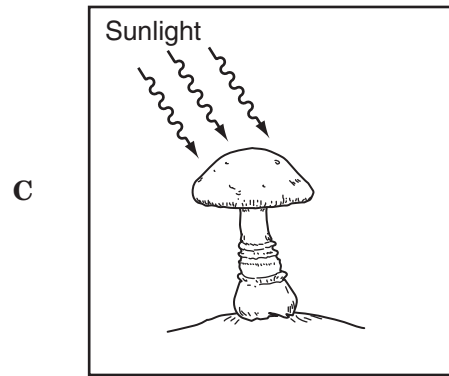
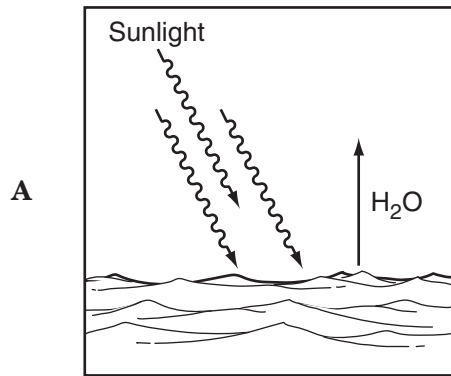
- 6 Which of the following diagrams best shows the relationships between the number of cells, tissues, and organs?



(6.10)(C)

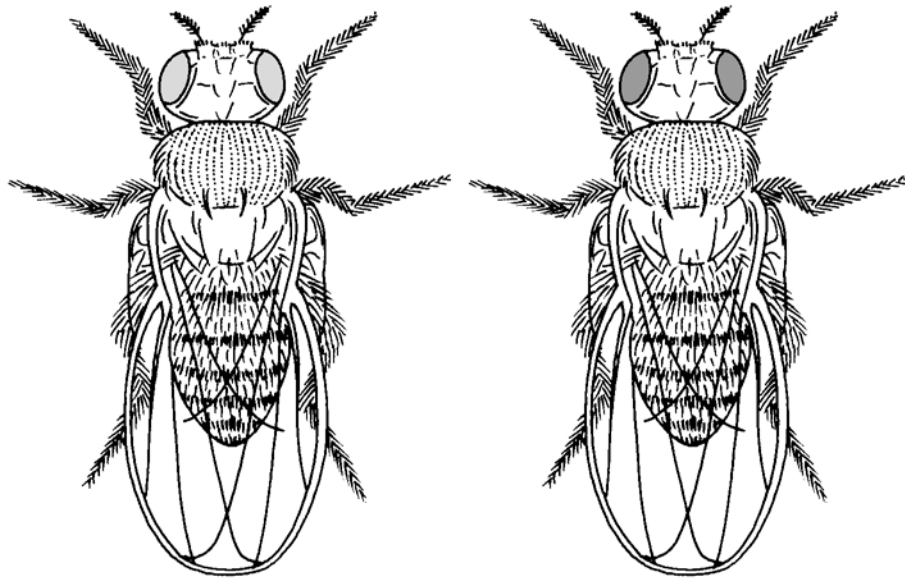
Cells are the basic building blocks of all life. Choice C is the correct answer because cells, found in the greatest number, compose tissues, and tissues combine to form organs.

7 Which diagram best shows the energy transformation from sunlight to chemical energy in an organism?



(7.8)(B)

This item tests students' ability to recognize the diagram (the dandelion) that correctly represents the transformation of energy from the sun into chemical energy. It is important that students understand that plants are one of the organisms (producers) that make their own food in this unique process (photosynthesis).



Red-eyed—Rr

Brown-eyed—rr

- 8 In *Drosophila melanogaster* (fruit flies), red eye color (R) is dominant over brown eye color (r). If the flies in the picture were crossed, what percent of their offspring would be expected to have brown eyes? Record and bubble in your answer on the answer document.

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

(8.11)(C)

This item is an example of combining a griddable item that requires a computation-based response with the understanding of basic genetics introduced at middle school. This item requires students to predict the chances of offspring inheriting a certain allele for a trait. Students must then determine the percent probability of the offspring with the trait. Since one of the parent fruit flies carries a dominant allele, the trait has a probability of being inherited in 50% of the offspring. Students should be able to use a Punnett square to predict probable outcomes of a genetic cross.

Objective 3: The student will demonstrate an understanding of the structures and properties of matter.

Besides knowing the basic parts of an atom, students will be introduced to the periodic table and common chemical formulas that represent compounds. The periodic table will be used as a tool to find information such as element names, symbols, atomic mass, number of protons and neutrons, and the physical and chemical properties of elements. Students must understand how the properties of the elements are used to place them in columns as groups, or families.

(6.7, 7.7, 8.9) **Science concepts.** The student knows that substances have physical and chemical properties. The student is expected to

- (B) classify substances by their physical and chemical properties (6.7);
- (C) recognize that compounds are composed of elements (7.7);
- (A) demonstrate that substances may react chemically to form new substances (8.9);
- (B) interpret information on the periodic table to understand that [physical] properties are used to group elements (8.9); and
- (C) recognize the importance of formulas and equations to express what happens in a chemical reaction (8.9).

(8.8) **Science concepts.** The student knows that matter is composed of atoms. The student is expected to

- (A) describe the structure and parts of an atom; and
- (B) identify the properties of an atom including mass and electrical charge.

(6.8, 7.8, 8.10) **Science concepts.** The student knows that complex interactions occur between matter and energy. The student is expected to

- (A) illustrate interactions between matter and energy including specific heat (8.10).

Highlights of Objective 3

- Students should be able to recognize the elements that make up common compounds, such as water, sugar, and salt. They should also be able to use the periodic table as a tool to identify chemical symbols and other information about elements.
- Students should be able to determine when a chemical reaction has occurred.
- At this grade level, items that include chemical equations will focus on identifying rearrangement of atoms; students will not be required to balance chemical equations.
- Students should understand the basic concept of conservation of mass (mass is neither lost nor destroyed in a regular chemical reaction).
- Students should recognize specific heat as a property of a substance and have a general understanding of how it affects the world around us. Basic applications of specific heat, such as why oceans hold heat better than large landmasses, may be tested; however, calculations of specific heat will not be tested.
- Students should know the difference between exothermic and endothermic reactions.

Objective 3 Sample Items

- 9 Which of the following situations contains an example of a chemical reaction?
- A Ice forming after water is placed in a freezer
 - B Watercolor paint drying on paper
 - C A sugar cube dissolving in a glass of water
 - D* A bicycle rusting after it is left in the rain

(8.9)(A)

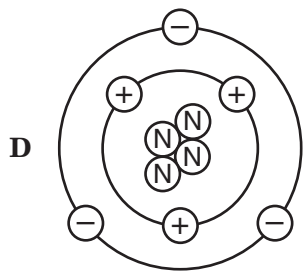
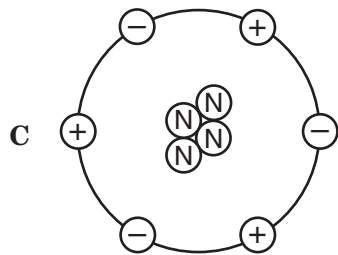
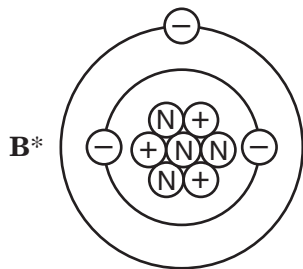
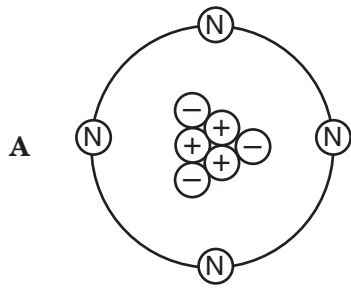
Students should be able to understand that substances may react to form new substances during a chemical reaction. Choice D is the correct answer because the other choices represent phase changes and mixtures, not chemical reactions. The rust on the bicycle is the only new substance formed as a result of a chemical reaction. The oxygen in the air has reacted with the iron of the bicycle's frame.

- 10 Which of the following groups of elements from the periodic table contains only metals?
- A* Group 12
 - B Group 14
 - C Group 16
 - D Group 18

(8.9)(B)

This item measures students' ability to recognize that element groups (families) are arranged on the periodic table according to their properties. Students should be able to identify metals, nonmetals, and metalloids from the periodic table. Option A (Group 12) is the only group in which all the member elements are metals.

11 Which of the following best represents the structure of a lithium (Li) atom?



(8.8)(A)

Students should have a basic understanding of the parts of an atom. In this item, students are expected to understand that protons (+) and neutrons (N) are located in the nucleus and electrons (-) outside the nucleus. All the options have the correct number of protons, neutrons, and electrons, but only Choice B has them arranged properly.

Objective 4: The student will demonstrate an understanding of motion, forces, and energy.

Objective 4 summarizes the relationships of forces, motion, and energy in geologic and physical phenomena that are generally familiar to students. Energy can also result in the flow of heat or the production of different types of waves, such as sound and light. Students should be expected to understand that various forces can generate or interfere with motion and that energy can be transformed from one form to another.

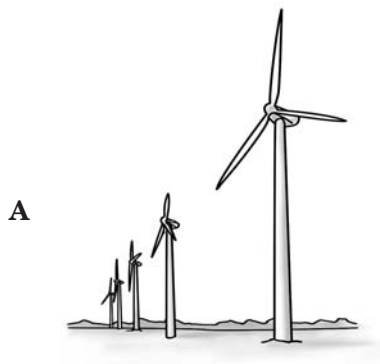
- (6.9) **Science concepts.** The student knows that obtaining, transforming, and distributing energy affects the environment. The student is expected to
- (A) identify energy transformations occurring during the production of energy for human use such as electrical energy to heat energy or heat energy to electrical energy.
- (6.8, 7.8, 8.10) **Science concepts.** The student knows that complex interactions occur between matter and energy. The student is expected to
- (A) illustrate examples of potential and kinetic energy in everyday life such as objects at rest, movement of geologic faults, and falling water (7.8).
- (6.6, 7.6, 8.7) **Science concepts.** The student knows that there is a relationship between force and motion. The student is expected to
- (B) demonstrate that changes in motion can be measured and graphically represented (6.6);
 - (A) demonstrate basic relationships between force and motion using simple machines including pulleys and levers (7.6);
 - (C) relate forces to basic processes in living organisms including the flow of blood and the emergence of seedlings (7.6);
 - (A) demonstrate how unbalanced forces cause changes in the speed or direction of an object's motion (8.7); and
 - (B) recognize that waves are generated and can travel through different media (8.7).

Highlights of Objective 4

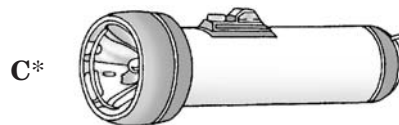
- Students should know the general characteristics of waves, including wavelength, frequency, and amplitude.
- Students must also understand that waves come in different forms, such as electromagnetic, water, seismic, and sound, and that waves can travel through different media.
- Energy takes various forms, such as thermal, chemical, mechanical, and electrical.
- Energy transformations found in everyday life will be emphasized. Students should know that an object at rest has potential energy and an object in motion has kinetic energy. Students should also understand that energy transformations occur in energy production, as in the conversion of wind energy to electrical energy.
- Room temperature, boiling point, and freezing point values, as well as other constants not given on the science chart, will be provided in the items that require them.
- Speed and motion are related to force. Some items may require simple calculations, and the formulas needed will appear on the science chart.

Objective 4 Sample Items

12 Which of the following devices converts chemical energy to light energy?



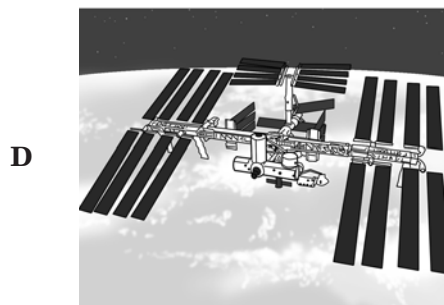
Wind turbines



Flashlight



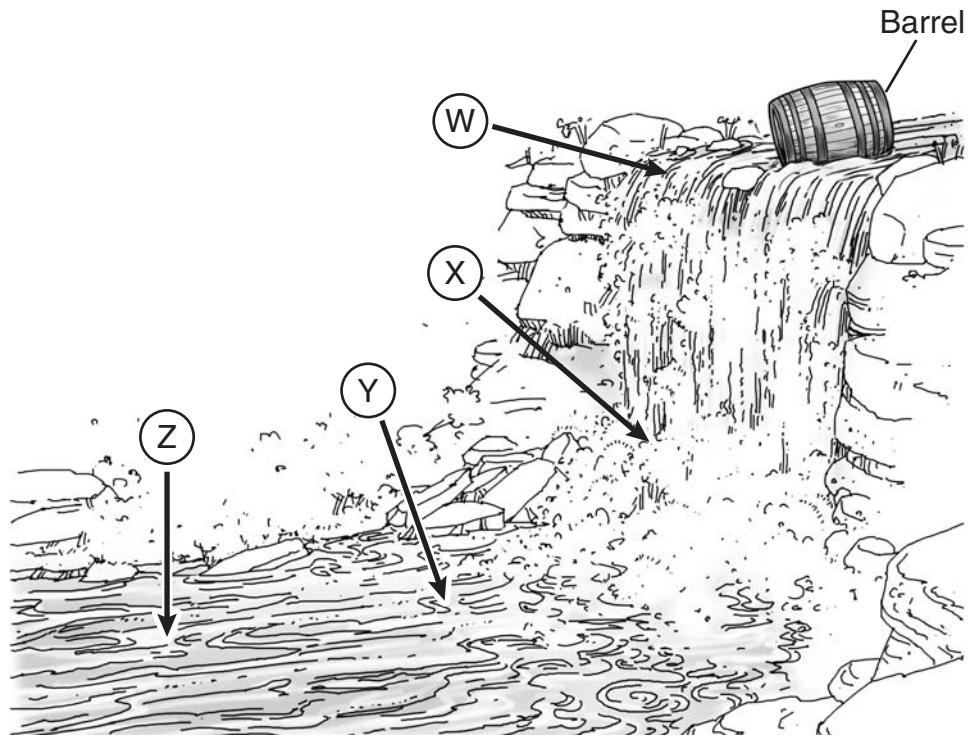
Electric lamp



Solar cells

(6.9)(A)

The student must identify which diagram represents the correct form of energy transformation. The flashlight is the only example that converts chemical energy (from its batteries) to light energy.

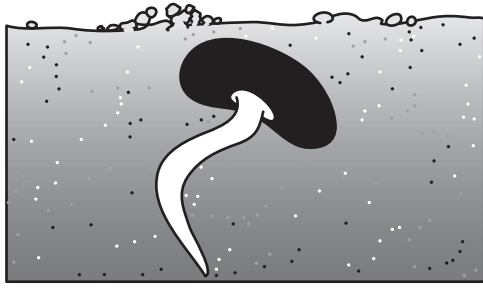


13 The diagram above shows a barrel moving toward a waterfall. The barrel will have the greatest potential energy at which of these locations?

- A* W
- B X
- C Y
- D Z

(7.8)(A)

Students should understand that potential energy is the energy of position. The barrel going over the waterfall has its greatest potential energy at the location indicated by the letter W because that is the highest point. As the barrel moves down the waterfall, its potential energy will decrease, while its kinetic energy will increase.



- 14 The picture shows a lima bean seedling as the root starts to grow into the soil. The root tip is able to push through the soil because it acts as a —
- A wheel
 - B pulley
 - C gear
 - D* wedge

(7.6)(A)

This item shows how a seedling root acts as a simple machine (a wedge). Because of its wedge shape, the root tip needs less force to push through the soil.

- 15 When the human heart contracts, it pumps blood to other parts of the body. When the heart contracts, the blood moves because the —
- A* pressure in the heart increases
 - B temperature of the blood increases
 - C density of the blood increases
 - D size of the heart increases

(7.6)(C)

This item about a beating heart demonstrates the relationship between biological processes, force, and motion. When the heart contracts, the increased pressure forces the blood to other parts of the body.

Objective 5: The student will demonstrate an understanding of earth and space systems.

In this objective students will extend their knowledge of earth and space systems from the TAKS elementary science test assessed at grade 5. Students will be expected to understand the relationships between Earth, the sun, and the moon; other components in the universe may also be included, such as stars, nebulae, and comets. Characteristics of the universe such as stars and galaxies may be integrated with all grade 8 objectives to make them more relevant. For example, an item might show a data table comparing the sun with other stars. Students should be able to use scientific process skills from Objective 1 to analyze information about stars from this data table. Throughout middle school, all the various cycles found on Earth will be taught, including the lunar, rock, nitrogen, water, and carbon cycles. For the middle school assessment, in addition to knowing what happens during each part of the cycle, students will also be expected to predict the results of modifying these cycles. The last concept in this objective will be testing students' understanding of how natural and human activity can alter earth systems, including natural disasters, gradual land changes, and human impacts on soil, water, and air quality.

(6.14) **Science concepts.** The student knows the structures and functions of Earth systems. The student is expected to

(B) identify relationships between groundwater and surface water in a watershed.

(6.13, 7.13) **Science concepts.** The student knows components of our solar system. The student is expected to

(A) identify and illustrate how the tilt of the Earth on its axis as it rotates and revolves around the Sun causes changes in seasons and the length of a day (7.13); and

(B) relate the Earth's movement and the moon's orbit to the observed cyclical phases of the moon (7.13).

(6.8, 7.8, 8.10) **Science concepts.** The student knows that complex interactions occur between matter and energy. The student is expected to

(B) explain and illustrate the interactions between matter and energy in the water cycle and in the decay of biomass such as in a compost bin (6.8); and

(B) describe interactions among solar, weather, and ocean systems (8.10).

(8.12) **Science concepts.** The student knows that cycles exist in Earth systems. The student is expected to

(A) analyze and predict the sequence of events in the lunar and rock cycles; and

(C) predict the results of modifying the Earth's nitrogen, water, and carbon cycles.

(8.13) **Science concepts.** The student knows characteristics of the universe. The student is expected to

(A) describe characteristics of the universe such as stars and galaxies.

(7.14, 8.14) **Science concepts.** The student knows that natural events and human activity can alter Earth systems. The student is expected to

(A) describe and predict the impact of different catastrophic events on the Earth (7.14);

(B) analyze effects of regional erosional deposition and weathering (7.14);

(C) make inferences and draw conclusions about effects of human activity on Earth's renewable, non-renewable, and inexhaustible resources (7.14);

(A) predict land features resulting from gradual changes such as mountain building, beach erosion, land subsidence, [and continental drift] (8.14);*

*TAKS will assess students' understanding of plate tectonics. The theory of plate tectonics is the most current and accepted theory of plate movement.

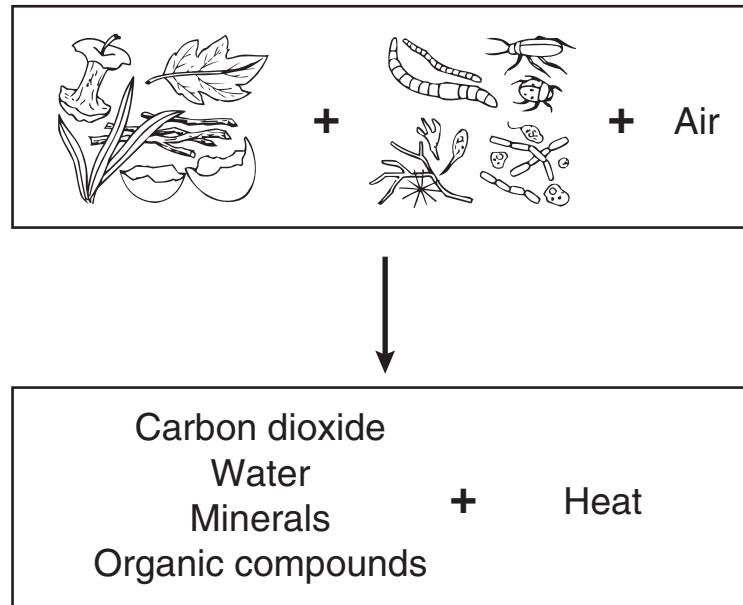
(B) analyze how natural or human events may have contributed to the extinction of some species (8.14); and

(C) describe how human activities have modified soil, water, and air quality (8.14).

Highlights of Objective 5

- Students should know and be able to predict the effects of modifications on Earth's most important cycles, such as the water, rock, nitrogen, and carbon cycles.
- The importance of the alteration of earth systems from both human interaction and catastrophic natural events will be assessed. Human alteration can include endangerment of species and use of natural resources as well as changes to soil, water, and air. Natural events can include volcanic eruptions, hurricanes, and gradual processes such as weathering, erosion, and deposition.
- Students are expected to understand the basic movements of Earth's plates and features of tectonics, such as rift valleys, trenches, seafloor spreading, and mountain building.
- Students should be able to identify the general phases of the moon, such as full moon and quarter moon, as well as general characteristics of the universe, such as stars, galaxies, nebulae, and comets.
- The interactions between matter and energy in solar, weather, and ocean systems are complex. These interactions may be addressed separately or jointly. For instance, a question may refer to an interaction involving the sun and the ocean but not refer to the weather. "Unbundling" these concepts is necessary for students to understand the parts of the whole.

Objective 5 Sample Items



- 16 The diagram above models decomposition. In nature dead material is broken down by decomposers, enriching the soil. A gardener can speed up this decomposition process by creating a compost pile. As the material in the compost pile decomposes —
- A the amount of gases decreases
 - B the materials are kept dry
 - C* heat is produced
 - D compounds produce light

(6.8)(B)

The diagram in this item models the complex interactions between matter and energy in the process of composting. Students should recognize that the decay of biomass occurs in composting. During this process dead organisms break down and enrich the soil, producing heat.

17 Many weather systems form over oceans. The energy needed to form these weather systems originates from —

- A** water currents
- B** prevailing winds
- C*** the sun
- D** the moon's gravity

(8.10)(B)

Another way to understand the complex interactions between matter and energy is to describe how solar, weather, and ocean systems interact. Students should be able to understand that the energy that drives weather systems originates from the sun.

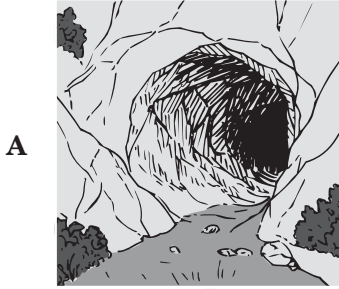
18 Nitrogen fertilizer is often added to soil to increase the growth of crops. Which of these nearby ecosystems would most likely be harmed by the use of nitrogen fertilizer?

- A** Forest
- B*** Pond
- C** Park
- D** Meadow

(8.12)(C)

An important concept to understand in Objective 5 is the various cycles in earth systems. In this example, water ecosystems would be harmed the most from fertilizer runoff, making Choice B, a pond, the correct answer. Fertilizer would increase the growth of water plants and algae, thus reducing the resources for some living organisms in the pond.

19 Which of the following was most likely caused by tectonic plates colliding?



Cavern



Lake



River



Mountain

(8.14)(A)

Students should be able to predict the impact of various natural events, such as the collision of tectonic plates. Mountains are often caused when two tectonic plates collide, pushing the land upward.

20 Several types of ground-nesting birds native to Madagascar became extinct after humans brought domestic cats to this large island. This is an example of which kind of threat to native animals?

- A Unregulated hunting
- B* Species introduction
- C Habitat destruction
- D Foreign animal trade

(8.14)(B)

This item measures a student's ability to recognize human activity that has contributed to the extinction of native species of wildlife. When humans introduced domestic cats to the island, these carnivores became a predator of ground-nesting birds.

Forest Ecosystem



- 21 A direct result of removing trees from the area above is most likely —
- A* a higher rate of erosion
 - B a lower amount of carbon dioxide in the air
 - C a rapid increase in herbivore populations
 - D a slowdown of the nitrogen cycle

(8.14)(C)

Students should recognize that removing trees might modify soil, water, and air quality. Deforestation has negative consequences on the environment. A higher rate of erosion would be a direct result of the tree removal shown here. Students should choose the best answer based on the information given in the item. Examples of positive effects of human activity on Earth's systems, such as habitat preservation or restoration, creation of artificial reefs, or natural-resource recycling, may also be presented in test items.

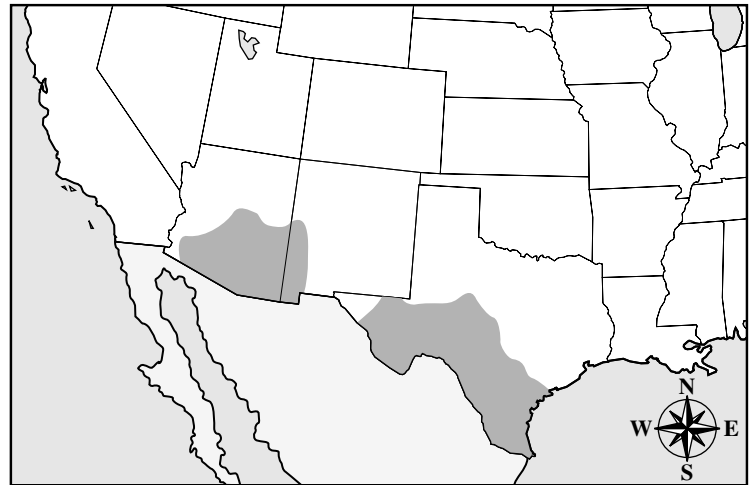
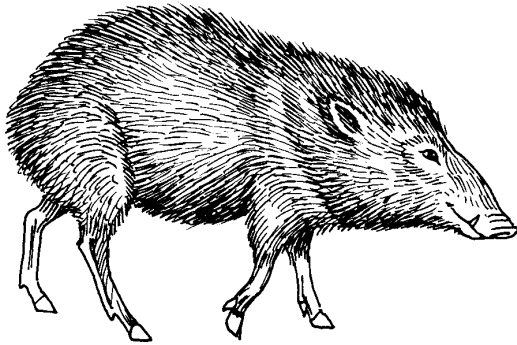
Cluster Examples

Cluster 1

Use the information below and your knowledge of science to answer questions 22–24.

The Javelina

Javelina Range in the Southwestern United States



Source: Lyle K. Sowls, *The Peccaries*, 1984.

The collared peccary, or javelina, is common in the southwestern United States, as shown by its range on the map. The javelina is also common in Mexico, Central America, and South America. Javelinas moved northward into Arizona about 200 years ago. They are usually most active at night and in the early morning. During the day they rest under trees or bushes to stay cool. Some more facts about the javelina are shown in the table below.

Javelina Facts

Height	50–60 cm
Length	87–102 cm
Mass	14–30 kg
Top speed	40–55 km/h
Fur colors	Dark brown to black
Tusk length	3–3.5 cm
Average lifespan	10 years
Habitats	Desert, grassland, forest
Food	Cacti, roots, leaves, insect larvae, worms, lizards, eggs
Main predators	Mountain lions, coyotes, bobcats, humans, jaguars

Range of Texas Prickly Pear Cactus in the Southwestern United States



- 22** Which of the following is the best conclusion based on the map above as compared to the map showing the javelina's range?
- A** Prickly pear cacti are a food source for javelinas.
 - B** Javelina populations are larger than prickly pear cacti populations.
 - C*** Prickly pear cacti and javelinas live in many of the same areas.
 - D** Javelinas are necessary for prickly pear cacti survival.

(8.2)(D)

Students are asked to interpret data from maps and draw conclusions. This item assesses the student's ability to use these scientific process skills. Choice C is the only choice that uses information from both maps.

- 23** From information in the table, javelinas are best described as —
- A** decomposers
 - B** producers
 - C*** omnivores
 - D** carnivores

(7.12)(B)

This item tests students' understanding of the relationship between organisms and the environment. It is important for students to identify and describe ecological roles (niches) within an ecosystem. Choice C is the correct answer; students should be able to see from the table that javelinas eat both plants and animals, which classifies them as omnivores.





- 24** Javelinas need strong leg muscles to help provide enough force for them to accelerate to high speeds. This fast movement can help javelinas escape from predators and reach the safety of the pack. If a javelina runs 42 m in 6 s, what is its average speed?
- A** 6 m/s
 - B*** 7 m/s
 - C** 48 m/s
 - D** 252 m/s

(8.7)(A)

In this item, a living organism exerts a force that results in movement. Students should know that motion can be the result of applied force. Choice B is the correct mathematical computation since 42 m divided by 6 s results in an average speed of 7 m/s.

Cluster 2

Use the information below and your knowledge of science to answer questions 25–27.

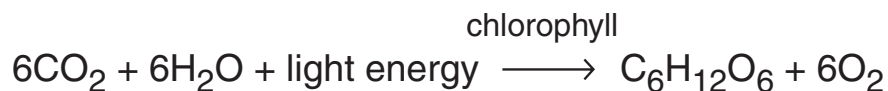
	Peanut 	Macadamia Nut 	Cashew 	Pistachio 
Place of Origin	Brazil, Peru	Australia	South American Rain Forest	Middle East
Time and Location First Grown in U.S.	Early 1800s Southeastern U.S.	Early 1880s Hawaii	Imported only	Mid-1800s Southern California
Type of Soil Needed to Grow	Silt, sand, clay	Open sand, lava rock, heavy clay	Sandy	Sandy loam
Ideal Soil pH	6.0–6.5 (slightly acidic)	5.5–6.5 (slightly acidic)	5.5–7.0 (acidic to neutral)	7.1–7.8 (slightly basic)
Ideal Temperature Range (°C)	13–30	7–26	10–40+	5–28
Ideal Amount of Water Needed (cm/yr)	30–45	15–31	50–100	30–45
Number of Calories (28 g serving)	160	203	160	157

25 Based on the information from the table, which of the four plants grows under the greatest range of ideal temperature, rainfall, and pH conditions?

- A Peanut
- B Macadamia nut
- C* Cashew
- D Pistachio

(7.12)(C)

Using the variety of data shown in this table, the student is expected to identify the relationship between organisms and the environment. Choice C is the correct answer because the data in the table demonstrate that the cashew grows in a greater range of ideal temperature, rainfall, and soil pH conditions than the other plants do.



26 Plants use the sun's energy to make food through photosynthesis. This chemical process is written as the chemical equation shown above. Which of the following lists the three elements that make up the compounds in this equation?

- A Chlorophyll, carbon, hydrogen
- B Carbon, sunlight, oxygen
- C* Carbon, oxygen, hydrogen
- D Water, oxygen, hydrogen

(7.7)(C)

In this item students must identify various elements that are found within compounds. The correct answer, Choice C, lists the three elements found in the photosynthesis equation. Students should recognize that chlorophyll, sunlight, and water are **not** elements.

27 Which of the following has the most food energy (calories) per serving?

- A** Peanuts
- B*** Macadamia nuts
- C** Cashews
- D** Pistachios

(8.10)(A)

The relationship between matter and energy is assessed in this item. Students must also be able to analyze the table. The macadamia nut has the greatest amount of food energy (calories) per serving, as shown in the table.

Appendix: Science Educator Resources

Texas Education Agency (TEA) Websites

TEA website: www.tea.state.tx.us

TEA Student Assessment website: www.tea.state.tx.us/student.assessment

Graduation Requirements for Science: www.tea.state.tx.us/curriculum/seg9-04.doc

Certification Requirements and PD Provider Number: www.sbec.state.tx.us

Science listserv: www.tea.state.tx.us/list (select “Science”)

Science curriculum: www.tea.state.tx.us/curriculum/science

Resources for Teaching Science

See www.statweb.org for these affiliates:

Texas Earth Science Teachers Association (TESTA)

Integrated Science Educators of Texas (ISET)

Texas Association of Environmental Educators (TAEE)

Texas Marine Educators Association (TMEA)

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/nse/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 assessment or curriculum, please feel free to contact:

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