STAAR Science Resources

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http://www.esc6.net

http://www.tea.state.tx.us/student.assessment/staar/

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STAAR Science Resources

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STAAR General Information

The State of Texas Assessments of Academic Readiness (STAAR)
A New Assessment Model

The state assessments will continue to be based on the Texas Essential Knowledge and Skills (TEKS), the standards designed to prepare students to succeed in college and careers and to compete globally. However, consistent with a growing national consensus regarding the need to provide a more clearly articulated K–16 education program that focuses on fewer skills and addresses those skills in a deeper manner, the Texas Education Agency (TEA) is implementing a new assessment model for the STAAR tests for elementary, middle, and high school.

The majority of the new STAAR assessments will test content students studied that year, as opposed to testing content studied over multiple years. Doing so will strengthen the alignment between what is taught and what is tested for a given course of study. While STAAR mathematics, reading, writing, and social studies assessments in grades 3–8 will continue to address only those TEKS taught in the given subject and grade, the content of other STAAR assessments will change in the following ways.

- Although the new science assessments for grades 5 and 8 will continue to address TEKS from multiple grade levels, these tests will focus on the science TEKS for those respective grades. The science assessments at these two grades will emphasize the 5th and 8th grade curriculum standards that best prepare students for the next grade or course; in addition, these assessments will include curriculum standards from two lower grades (i.e., grades 3 and 4 or grades 6 and 7) that support students' success on future science assessments. In contrast, the current Texas Assessment of Knowledge and Skills (TAKS) assessments uniformly address TEKS from multiple grade levels without any specific emphasis.

- The new end-of-course assessments will address only the TEKS for a given course, as opposed to the high school level TAKS assessments, which address TEKS from multiple courses.

By focusing on the TEKS that are most critical to assess, STAAR will better measure the academic performance of students as they progress from elementary to middle to high school. Based on educator committee recommendations, TEA has identified for each grade or course a set of knowledge and skills drawn from the TEKS eligible to be assessed and emphasized this set of knowledge and skills, called readiness standards, on the assessments. The remaining knowledge and skills are considered supporting standards and will be assessed, though not emphasized.

Readiness standards have the following characteristics.

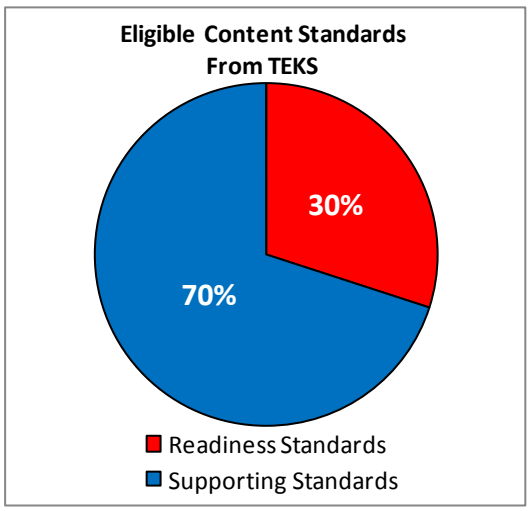
- They are essential for success in the current grade or course.
- They are important for preparedness for the next grade or course.
- They support college and career readiness.
- They necessitate in-depth instruction.
- They address broad and deep ideas.

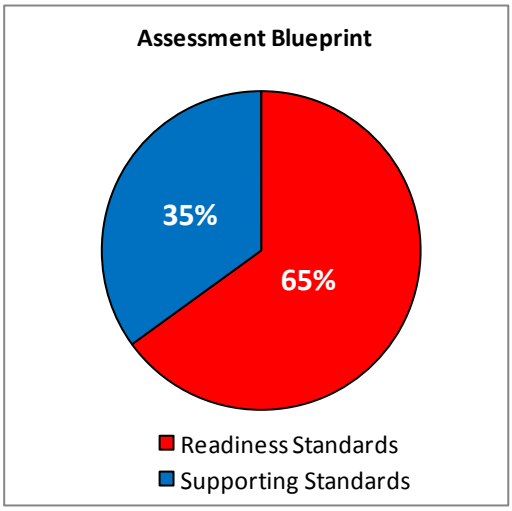
Supporting standards have the following characteristics.

- Although introduced in the current grade or course, they may be emphasized in a subsequent year.
- Although reinforced in the current grade or course, they may be emphasized in a previous year.

- They play a role in preparing students for the next grade or course but not a central role.
- They address more narrowly defined ideas.

Example





TEA is also implementing a number of changes that should serve to test knowledge and skills in a deeper way.

- Tests will contain a greater number of items that have a higher cognitive complexity level.
- Items will be developed to more closely match the cognitive complexity level evident in the TEKS.
- In reading, greater emphasis will be given to critical analysis than to literal understanding.
- In writing, students will be required to write two essays rather than one.
- In social studies, science, and mathematics, process skills will be assessed in context, not in isolation, which will allow for a more integrated and authentic assessment of these content areas.
- In science and mathematics, the number of open-ended (griddable) items will increase to allow students more opportunity to derive an answer independently.

A Comparison of Assessment Attributes
Texas Assessment of Knowledge and Skills (TAKS) to
State of Texas Assessment of Academic Readiness (STAAR)

Assessment Attributes	TAKS Assessment Program	STAAR Assessment Program
Assessed Curriculum	o During initial TAKS development, Texas Essential Knowledge and Skills (TEKS) student expectations to be assessed were determined by Texas educators. o Test objectives that matched the student expectations were developed. o Blueprints for each assessment—the number of items per objective and on the overall test––were developed, with test lengths ranging from 30–60 items. o At grades 3–8, content areas assess grade-specific content, with the exception of science at grades 5 and 8, which assess multiple grades of science curriculum. o At grades 9–11, grade-level assessments assess content from multiple courses.	o Educator committees identify which TEKS cannot be assessed on a paper/pencil assessment, which TEKS should be emphasized because they are necessary both for success in the current subject/grade or course and for preparedness in the next subject/grade or course, and which TEKS are considered supporting and should be assessed but receive less emphasis. o New test blueprints will emphasize the assessment of the curriculum standards that best prepare students for the next grade or course. o The assessments will encompass only the curriculum for that grade or course, with the exception of science at grades 5 and 8. The science assessments at these two grades will emphasize the 5th and 8th grade curriculum standards that best prepare students for the next grade or course; in addition, these assessments will include curriculum standards from two lower grades (i.e., grades 3 and 4 or grades 6 and 7) that support students' success on future science assessments.
Rigor of Assessment	o The item-development process has been consistently followed once item-writer guidelines were developed in 2001. o Performance standards were recommended by standard-setting committees and approved by the SBOE in November 2002. o Because performance standards have remained consistent since the first operational administration in 2003 and after the phase-in of standards, students have "outgrown" the assessments. o Measuring students' growth within the "Commended" performance category is difficult because too few items are rigorous enough to reflect this performance category	o Assessments will increase in length at most grades and subjects. o Overall test difficulty will be increased by including more rigorous items. o The rigor of items will be increased by assessing skills at a greater depth and level of cognitive complexity. In this way, the tests will be better able to measure the growth of higher-achieving students. o In science and mathematics, the number of open-ended (griddable) items on most tests will increase to allow students more opportunity to derive an answer independently. o Students will be required to respond to two writing tasks (including personal narrative, literary, expository, persuasive, and analytic) rather than one task. o Performance standards will be set using empirical data gathered from studies that link performance year to year from grades 3–8 to high school and from specific courses to college and career readiness. o Empirical studies will be conducted comparing students' performance on

Assessment Attributes	TAKS Assessment Program	STAAR Assessment Program
	and many students "top out" on the assessments.	the new assessments with nationally norm-referenced assessments. o Performance standards will be reviewed at least once every three years and, if necessary, adjusted to ensure that the assessments maintain a high level of rigor. o Performance standards will be set so that they require a higher level of student performance than is required on the current TAKS assessments.
Field-Testing Process	o From 2003–2007, stand-alone field testing for grades 4 and 7 writing, grade 9 reading, grade 10 and exit level English language arts, (ELA), and grade 5 Spanish reading and mathematics occurred annually; however, in 2008, stand-alone field testing moved to every other year. o For all other subject areas, field-test items have been embedded in operational assessments.	o For grade 7 writing and for each end-of-course assessment, there is a one-time only stand-alone field test. o Once STAAR assessments are operational, all field testing will be embedded, with the exception of grade 4 writing, which will require an abbreviated stand-alone field test every three years.
Performance Standards	o Performance standards were set separately for each grade and subject. o Performance standards were set based on the examination of test content.	o Performance standards will be set as an aligned system across grades and courses within a content area (from grades 3–8 through high school). o Performance standards will be set based on data from empirical studies of other state, national, and international assessments as well as on the examination of test content.
Test Administration Procedures	o All assessments are currently administered within a one-day time frame. o Online testing is offered for exit-level retests only.	o Grades 4 and 7 writing as well as English I, II, and III will be administered over two days to assess writing more comprehensively and allow for the inclusion of embedded field-test items. o End-of-course assessments will be made available on paper and online.
Measures of Student Progress	o Measures of student progress for the growth model were developed and implemented after the TAKS program was established. o Growth measures are projections to the "Met Standard" performance level at the next high-stakes grade (5, 8, and 11). o Growth measures provide information about whether students are on track to meet the passing standard in the next high-stakes grade.	o Measures of student progress for the growth model will be developed and implemented as STAAR assessments are developed and implemented. o Progress measures will be based on the new, more rigorous standards for STAAR assessments. o Progress measures will be phased in over several years as data for the new program become available. o Progress measures may provide an early-warning indicator for students that are not on track to meet the passing standard, may not be successful in the next grade or course, may not be ready for advanced courses in mathematics and English in high school, or may not be college or career ready in mathematics and English.

Assessment Attributes	TAKS Assessment Program	STAAR Assessment Program
Number of Testing Days	***Total – 19 (27 with SSI retesting)*** o Grade 3 – reading and mathematics (2 days) o Grade 4 – reading, mathematics, and writing (3 days) o Grade 4 – writing field test (1 day) o Grade 5 – reading, mathematics, and science (3 days; up to 7 days for SSI retesting) o Grade 6 – reading and mathematics (2 days) o Grade 7 – reading, mathematics, and writing (3 days) o Grade 7 – writing field test (1 day) o Grade 8 – reading, mathematics, science, and social studies (4 days; up to 8 days for SSI retesting) ***Total – 13 (25 with Exit Level retesting)*** o Grade 9 – reading and mathematics (2 days) o Grade 9 – reading field test (1 day) o Grade 10 – ELA, mathematics, science, and social studies (4 days) o Grade 10 – ELA field test (1 day) o Grade 11 (Exit Level) – ELA, mathematics, science, and social studies (4 days; up to 16 days for retesting) o Exit Level – ELA field test (1 day)	***Total – 19 (27 with SSI retesting)*** o Grade 3 – reading and mathematics (2 days) o Grade 4 – reading, mathematics, and writing (4 days; writing now a 2-day administration) o Grade 5 – reading, mathematics, and science (3 days; up to 7 days for SSI retesting) o Grade 6 – reading and mathematics (2 days) o Grade 7 – reading, mathematics, and writing (4 days; writing now a 2-day administration) o Grade 8 – reading, mathematics, science, and social studies (4 days; up to 8 days for SSI retesting) ***Total – 15 (45 with retesting)*** o English I (2 days) o English II (2 days) o English III (2 days) o Algebra I (1 day) o Geometry (1 day) o Algebra II (1 day) o World History (1 day) o World Geography (1 day) o U.S. History (1 day) o Biology (1 day) o Chemistry (1 day) o Physics (1 day) o 2 additional testing opportunities per year
Assessments for English Language Learners (ELLS) at Grades 3–8 and High School	The majority of ELLs participate in TAKS in English (grades 3 through exit level) or TAKS in Spanish (grades 3–5) **Grades 3–10:** o Eligible recent immigrant ELLs may, however, be granted a limited English proficiency (LEP) exemption for up to three years under state law.	o The vast majority of ELLs will participate in STAAR in English (grades 3 through high school) or STAAR in Spanish (grades 3–5). o State exemption policies and linguistically accommodated assessment methods for immigrant ELLs are under review, with the goal of expanding valid and reliable linguistic accommodation methods and including more recent immigrant ELLs in the state assessment system.

Assessment Attributes	TAKS Assessment Program	STAAR Assessment Program
	o Students exempt under Texas law are required to test in federally mandated grades and subjects (grades 3–8 and 10 mathematics and reading; grades 5, 8, and 10 science). In these grades and subjects, they take TAKS with linguistic accommodations, as permitted by federal regulations. In other grades and subjects, they do not take TAKS while exempt under state law. **Exit level:** o ALL ELLs must pass exit level TAKS to meet graduation requirements. There are no exemptions. o Exit level testing, however, may be postponed during an eligible immigrant ELL's first 12 months in U.S. schools.	
Assessments for Students Receiving Special Education Services	o Assessments for students receiving special education services—an accommodated form, a modified assessment, and an alternate assessment—were developed. o All these assessments are aligned to the TEKS as well as to the TAKS objectives, but the test blueprints for the modified and alternate assessments differ from TAKS. o Separate performance standards were set on the modified and alternate assessments. However, performance standards for the accommodated form are the same as TAKS. o These assessments were developed after the TAKS program was well established.	o For students receiving special education services, modified and alternate versions of the STAAR assessments will be developed, although it is possible that all 12 end-of-course assessments may not be developed due to the nature of the coursework actually taken by students who are eligible to participate in these assessments. o The modified and alternate assessments will be aligned to the TEKS as well as to the reporting categories for STAAR, although the test blueprints for these assessments will differ from the general assessments. o Separate performance standards will be set on the modified and alternate versions of STAAR. o The alternate assessments will be developed at the same time and in coordination with STAAR development activities, providing for greater continuity and alignment between the general and alternate assessments.
Equating	o The TAKS program has used both pre- and post-equating models to verify that the assessments maintain the same level of difficulty from year to year. o Post-equating has been done using the base test items as the linking items to maintain difficulty from year to year.	o TEA is considering using both pre- and post-equating models to verify that the STAAR assessments maintain the same level of difficulty from year to year. o A new post-equating design that uses embedded linking items on a subset of test forms is being considered for assessments at grades 3–8 as well as for English I, II, and III.

Performance Labels and Policy Definitions for the State of Texas Assessments of Academic Readiness (STAAR™)

The Texas Education Agency (TEA), in cooperation with the Texas Higher Education Coordinating Board (THECB), convened a Performance Descriptor Advisory Committee (PDAC) in fall 2010 to recommend performance labels and policy definitions for the performance standards of the State of Texas Assessments of Academic Readiness (STAAR). The purpose of the performance labels and policy definitions is to describe the general level of knowledge and skills evident at each performance level for all grades and subjects. The committee represented the diversity of stakeholders in public education and higher education in Texas. For more information about committee membership and the discussions and recommendations of this committee, a report is available in Appendix A of the House Bill 3 Transition Plan at http://www.tea.state.tx.us/student.assessment/hb3plan/.
Following the meeting, TEA staff used the PDAC recommendations to draft final TEA staff recommendations for performance labels and policy definitions. These staff recommendations were presented to a representative group of PDAC members and received their unanimous approval. The commissioner of education subsequently approved the recommendations.

There will be two cut scores, which will identify three performance categories. For the general STAAR assessments, STAAR Modified, and linguistically accommodated forms of STAAR, the labels for the performance categories are

- Level III: Advanced Academic Performance
- Level II: Satisfactory Academic Performance
- Level I: Unsatisfactory Academic Performance

Below are the policy definitions for the general STAAR assessments.

Level III: Advanced Academic Performance*
Performance in this category indicates that students are well prepared for the next grade or course. They demonstrate the ability to think critically and apply the assessed knowledge and skills in varied contexts, both familiar and unfamiliar. Students in this category have a high likelihood of success in the next grade or course with little or no academic intervention.
**For Algebra II and English III, this level of performance also indicates students' postsecondary readiness.*

Level II: Satisfactory Academic Performance
Performance in this category indicates that students are sufficiently prepared for the next grade or course. They generally demonstrate the ability to think critically and apply the assessed knowledge and skills in familiar contexts. Students in this category have a reasonable likelihood of success in the next grade or course but may need short-term, targeted academic intervention.

Level I: Unsatisfactory Academic Performance
Performance in this category indicates that students are inadequately prepared for the next grade or course. They do not demonstrate a sufficient understanding of the assessed knowledge and skills. Students in this category are unlikely to succeed in the next grade or course without significant, ongoing academic intervention.

For the STAAR Alternate assessments, the performance labels are

- Level III: Accomplished Academic Performance
- Level II: Satisfactory Academic Performance
- Level I: Unsatisfactory Academic Performance

Now that the definitions have been approved for the general assessments, policy definitions for STAAR Modified and STAAR Alternate will be developed. These definitions will be posted when they have been approved.

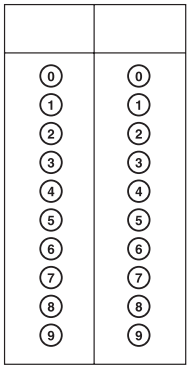
State of Texas Assessments of Academic Readiness (STAAR™)
Griddable Items for Science and Mathematics

For the general science and mathematics assessments, the STAAR program will use a type of open-ended question known as a griddable item. The purpose of griddable items is to provide students opportunities to derive answers independently without being influenced by answer choices provided with the questions. Most science and mathematics assessments will include 3 to 5 griddable items.

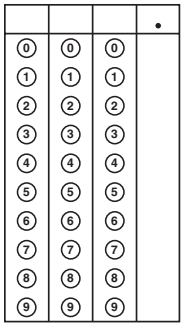
Griddable Items for STAAR Grades 3–8 Assessments

- The correct answer will be a positive number.
- The answer grids include a fixed decimal point with the exception of grade 3, which does not have a decimal point.
- Students must enter their answer in the correct columns with respect to the fixed decimal point.
- Students must enter their answer in the boxes and then fill in the corresponding bubbles.
- Students do not have to use all the boxes.
- Extra zeros may be filled in (either before or after the answer) as long as their placement does not affect the value of the answer.

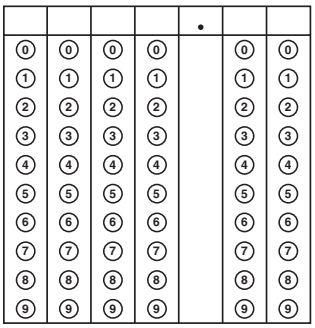
Grade 3 Assessment



Grades 4–5 Assessments



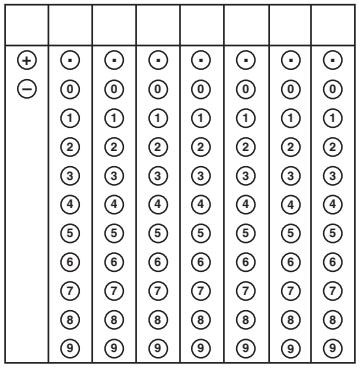
Grades 6–8 Assessments



Griddable Items for STAAR EOC Assessments

- The correct answer can be a positive or a negative number. If the answer is a negative number, students must enter a negative sign. If no sign is marked, the answer will default to a positive number.
- The answer grid includes a floating decimal point. If the answer is a decimal number, students must enter a decimal point.
- Students must enter their answer in the boxes (paper and online) and then fill in the corresponding bubbles (paper only).
- Students do not have to use all the boxes and can place their answer in any set of consecutive boxes.
- Extra zeros may be filled in (either before or after the answer) as long as their placement does not affect the value of the answer.

End-of-Course Assessments



Texas Education Agency
Student Assessment Division
Fall 2010

State of Texas Assessments of Academic Readiness (STAAR™)
Assessing Process Skills

As part of the effort to provide a clearly articulated assessment program that focuses on fewer skills and addresses those skills in a deeper manner, the Texas Education Agency (TEA) is changing the way process skills are assessed on all social studies tests, all science tests, and grades 3–8 mathematics tests. For the STAAR program, process skills in social studies, science, and mathematics will be assessed in context, not in isolation, which will allow for a more integrated and authentic assessment of these content areas. Process skills will be incorporated into test questions and reported along with content skills under the content reporting categories. Process skills will not be listed under a separate reporting category as was done previously with the Texas Assessment of Knowledge and Skills (TAKS) program. TEA will report both content and process student expectations for test questions that address a content skill and incorporate a process skill. Tests will have a minimum percent of questions that include both content and process skills. More detailed information about assessing process skills in social studies, science, and mathematics is provided below.

STAAR Social Studies Assessments

The student expectations addressing **social studies skills** remain part of the TEKS for social studies at all grade levels. In the new STAAR social studies assessments, there is not a separate reporting category for process skills similar to TAKS objective 5. Instead, these skills will be incorporated into at least 30% of the test questions from the content reporting categories and will be reported along with the content standards.

Examples of a few of the process skills included in the **social studies skills** strand of the TEKS are listed below.

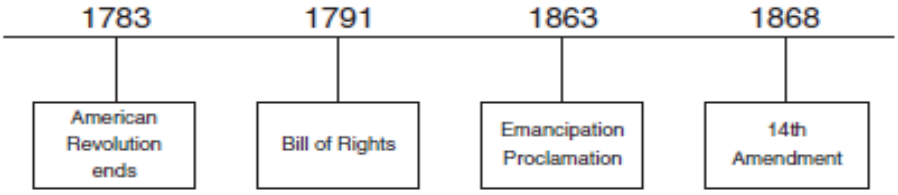
- (WH.30) **Social studies skills.** The student communicates in written, oral, and visual forms. The student is expected to
  (C) interpret and create written, oral, and visual presentations of social studies information.

- (US.29) **Social studies skills.** The student applies critical-thinking skills to organize and use information acquired from a variety of valid sources, including electronic technology. The student is expected to
  (B) analyze information by sequencing, categorizing, identifying cause-and-effect relationships, comparing and contrasting, finding the main idea, summarizing, making generalizations, making predictions, drawing inferences, and drawing conclusions.

- (8.29) **Social studies skills.** The student applies critical-thinking skills to organize and use information acquired through established research methodologies from a variety of valid sources, including electronic technology. The student is expected to
  (D) identify points of view from the historical context surrounding an event and the frame of reference which influenced the participants.

Test Question from Grade 8 Social Studies

Use the diagram and your knowledge of social studies to answer the following question.



What conclusion can be drawn from the diagram above?

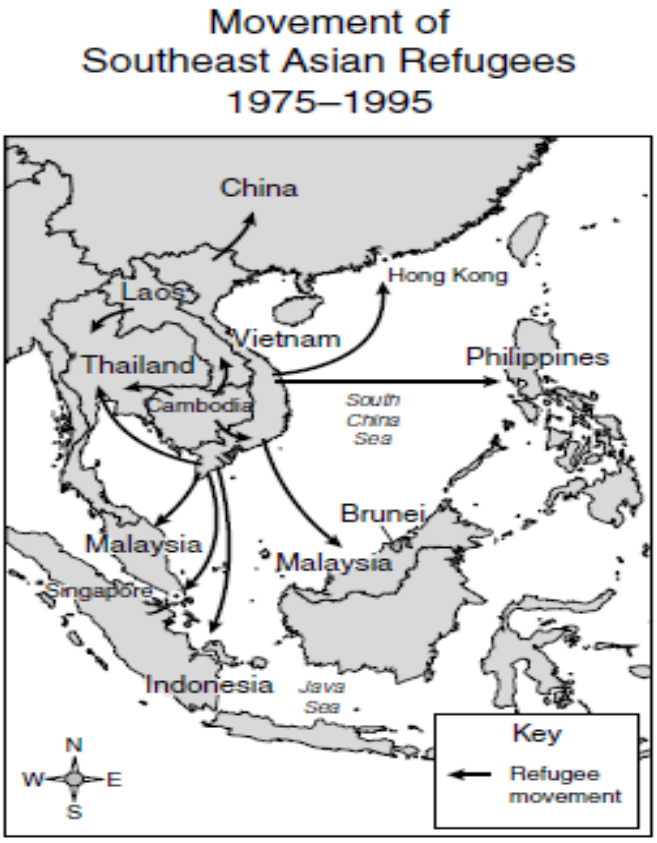
*A** *The United States was becoming increasingly concerned with individual liberties.*
B *The United States was becoming increasingly isolated from foreign affairs.*
C *The United States increasingly limited opportunities for minorities.*
D *The United States increasingly feared the creation of a strong central government.*

This test question addresses

Content: 8.15D, analyze how the U.S. Constitution reflects the principles of limited government, republicanism, checks and balances, federalism, separation of powers, popular sovereignty, and individual rights

Process: 8.29B, analyze information by sequencing, categorizing, identifying cause-and-effect relationships, comparing, contrasting, finding the main idea, summarizing, making generalizations and predictions, and drawing inferences and conclusions

Test Question from High School Social Studies



Source: UN High Commission for Refugees

The movement of Southeast Asian refugees between 1975 and 1995, as shown in the map above, was a direct result of —

A *the spread of capitalism in the region*
*B** *political upheaval in Vietnam and Cambodia*
C *numerous job opportunities in the Philippines*
D *destructive floods in Cambodia and Laos*

This test question addresses

Content: G.18A, analyze cultural changes in specific regions caused by migration, war, trade, innovation and diffusion

Process: G.21C, create and interpret different types of maps to answer geographic questions, infer relationships, and analyze change

STAAR Science Assessments
The student expectations addressing **scientific processes** remain part of the TEKS for science at all grade levels. In the new STAAR science assessments, there is not a separate reporting category for process skills similar to TAKS objective 1. Instead, these skills will be incorporated into at least 40% of the test questions from the content reporting categories and will be reported along with the content standards.

Examples of a few of the process skills included in the **scientific processes** strand of the TEKS for science are listed below.

- (B.1) **Scientific processes.** The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to
  (A) demonstrate safe practices during laboratory and field investigations.

- (P.2) **Scientific processes.** The student uses a systematic approach to answer scientific laboratory and field investigative questions. The student is expected to
  (E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness.

- (8.2) **Scientific investigation and reasoning.** The student uses scientific inquiry methods during laboratory and field investigations. The student is expected to
  (C) collect and record data using the International System of Units (SI) and qualitative means such as labeled drawings, writing, and graphic organizers.

- (5.3) **Scientific investigation and reasoning.** The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to
  (B) evaluate the accuracy of the information related to promotional materials for products and services such as nutritional labels.

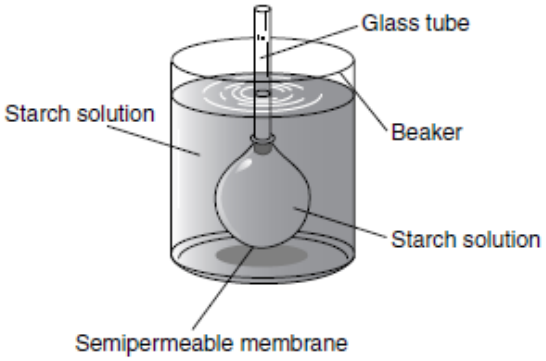
<u>Test Question from Grade 5 Science</u>

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

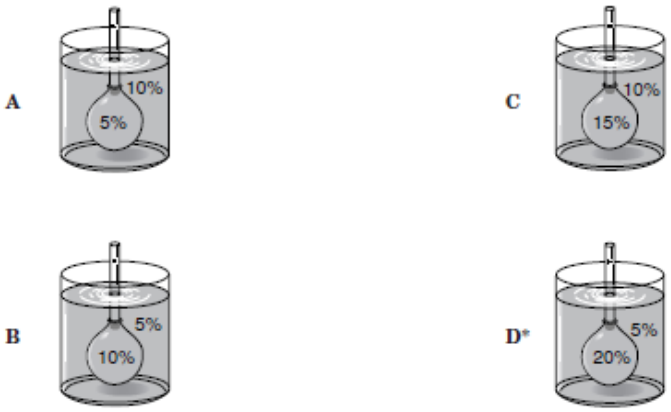
A *Use wooden blocks instead of foam balls*
*B** *Make the sun larger than the Earth and the moon smaller*
C *Move the sun closer to the Earth*
D *Change the order of the foam balls to be moon, sun, Earth*

This test question addresses
Content: 5.8D, identify and compare the physical characteristics of the Sun, Earth, and Moon
Process: 5.3C, draw or develop a model that represents how something works or looks that cannot be seen such as how a soda dispensing machine works

Test Question from High School Science



The illustration above shows a cell model with starch solutions both inside and outside the cell. In which of the following situations will the solution rise highest in the tube?



This test question addresses

Content: B.4B, investigate and explain cellular processes, including homeostasis, energy conversions, transport of molecules, and synthesis of new molecules

Process: B.2E plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology

STAAR Mathematics Assessments for Grades 3–8
The student expectations addressing **underlying processes and mathematical tools** remain part of the TEKS for mathematics in grades 3–8. In the new STAAR mathematics assessments for grades 3–8, there is not a separate reporting category for process skills similar to TAKS objective 6. Instead, these skills will be incorporated into at least 75% of the test questions from the content reporting categories and will be reported along with the content standards.

Examples of a few of the process skills included in the **underlying processes and mathematical tools** strand of the TEKS for grades 3–8 mathematics are listed below.

- (8.14) **Underlying processes and mathematical tools.** The student applies Grade 8 mathematics to solve problems connected to everyday experiences, investigations in other disciplines, and activities in and outside of school. The student is expected to
  (A) identify and apply mathematics to everyday experiences, to activities in and outside of school, with other disciplines, and with other mathematical topics.

- (6.11) **Underlying processes and mathematical tools.** The student applies Grade 6 mathematics to solve problems connected to everyday experiences, investigations in other disciplines, and activities in and outside of school. The student is expected to
  (B) use a problem-solving model that incorporates understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness.

- (4.15) **Underlying processes and mathematical tools.** The student communicates about Grade 4 mathematics using informal language. The student is expected to
  (B) relate informal language to mathematical language and symbols.

- (3.16) **Underlying processes and mathematical tools.** The student uses logical reasoning. The student is expected to
  (A) make generalizations from patterns or sets of examples and nonexamples.

<u>Test Question from Grade 3 Mathematics</u>

Melissa had some money in her purse when she went to the mall with her mother. She spent $5 on a book. Then her mother gave her $10. After Melissa spent $2 on a snack, she had $23 in her purse. How much money did Melissa have in her purse when she first went to the mall? Mark your answer.

A $26
B $17
C $20*
D $6

This test question addresses
Content: 3.3B, select addition or subtraction and use the operation to solve problems involving whole numbers through 999
Process: 3.14C, select or develop an appropriate problem-solving plan or strategy, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem

Test Question from Grade 5 Mathematics

There are 319 students who volunteered to work at a craft fair. An equal number of volunteers came from each of 4 grade levels. About how many volunteers came from each grade level?

A 100
B 80*
C 325
D 40

This test question addresses

Content: 5.4A, use strategies, including rounding and compatible numbers to estimate solutions to addition, subtraction, multiplication, and division problems

Process: 5.14B, solve problems that incorporate understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness

Additional examples of test questions that assess content and incorporate process skills from the TEKS will be provided in the future.

Laboratory and Field Investigations
Frequently Asked Questions

August 2010

1. What is a laboratory investigation?

A school laboratory investigation (also referred to as a lab) is defined as an experience in the laboratory, the classroom, or the field that provides students with opportunities to interact directly with natural phenomena or with data collected by others using tools, materials, data collection techniques, and models (National Research Council, *National Science Education Standards*, 2006, p. 3).

2. Are there any new laboratory and field requirements in the 2010 science TEKS?

Yes. In the new Texas Essential Knowledge and Skills (TEKS) for science, laboratory and field investigations will take on increased importance. First, the 40% time requirement has been expanded from the high school level to the middle school level. Second, science equipment and supplies are now specified at the high school level, expanding on the K-8 requirements. Third, the elementary-level science TEKS now have recommendations for time percentages.

- How much laboratory and field time is suggested for elementary school science programs?

  In grades K-1, districts are encouraged to facilitate classroom and outdoor investigations for at least 80% of instructional time.

  In grades 2-3, districts are encouraged to facilitate classroom and outdoor investigations for at least 60% of instructional time.

  In grades 4-5, districts are encouraged to facilitate classroom and outdoor investigations for at least 50% of instructional time.

- How much laboratory and field time is required for middle school science programs?

  In grades 6-8, students for at least 40% of instructional time, conduct laboratory and field investigations.

- How much laboratory and field time is required for high school science programs?

  For all courses that receive science credit in grades 9-12, students for at least 40% of instructional time, conduct laboratory and field investigations.

All of the science TEKS are found in 19 Texas Administrative Code (TAC), Chapter 112, and are available at http://ritter.tea.state.tx.us/rules/tac/chapter112/index.html.

3. What types of investigations are cited in the 2010 science TEKS?

The 2010 science TEKS reference three types of investigations—descriptive, comparative, and experimental.

- **Descriptive investigations** involve collecting qualitative and/or quantitative data to draw conclusions about a natural or man-made system (e.g., rock formation, animal behavior, cloud, bicycle, electrical circuit). A descriptive investigation includes a question, but no hypothesis. Observations are recorded, but no comparisons are made and no variables are manipulated.

- **Comparative investigations** involve collecting data on different organisms/objects/ features/events, or collecting data under different conditions (e.g., time of year, air temperature, location) to make a comparison. The hypothesis identifies one independent (manipulated) variable and one dependent (responding) variable. A "fair test"* can be designed to measure variables so that the relationship between them is determined.

- **Experimental investigations** involve designing a "fair test"* similar to a comparative investigation, but a control is identified. The variables are measured in an effort to gather evidence to support or not support a causal relationship. This is often called a "controlled experiment."

* A fair test is conducted by making sure that only one factor (variable) is changed at a time, while keeping all other conditions the same.

4. How can classroom teachers design scientific descriptive and comparative investigations?

Science often emphasizes experimental investigation in which students actively manipulate variables and control conditions. In studying the natural world, it is difficult to actively manipulate variables and maintain "control" and "experimental" groups, so field investigation scientists look for descriptive or comparative trends in naturally occurring events. Many field investigations begin with counts (gathering baseline data). Later, measurements are intentionally taken in different locations (e.g., urban and rural, or where some natural phenomenon has created different plot conditions) because scientists suspect they will find a difference. In contrast, in controlled experiments, scientists begin with a hypothesis about links between variables in a system.

5. What types of variables are there in an experiment?

- **Manipulated (changed) variable, also called the independent variable** – the factor of a system being investigated that is deliberately changed to determine that factor's relationship to the responding variable
- **Responding variable, also called the dependent variable** – the factor of a system being investigated that changes in response to the manipulated variable and is measured
- **Controlled variables** – the conditions that are kept the same in a scientific investigation

6. What are the guidelines for field investigations?

- **Guidelines for Instructional Field Experiences** – This brochure is designed to provide administrators with information to support field investigations on the campus. This brochure is available on the TEA science website.
- **Field Investigations: Using Outdoor Environments to Foster Student Learning of Scientific Processes** – This document contains examples of descriptive and comparative investigations. This document is available at http://www.fishwildlife.org/pdfs/Field%20Investigation%20Guide.pdf.

7. What are the rules and laws regarding safety in science investigations?

Safety information, including classroom, laboratory, and field investigations is available in the Safety Standards. The new science TEKS have expanded the required safety equipment for grades K-12.

8. How many students can be placed in a science class?

Schools should carefully consider the actual size of the classroom and laboratory space and how that relates to safety. See question 9 below for further information.

9. What are the size requirements for school laboratories?

The following requirements for school facility standards shall apply to projects for new construction or major space renovations for which the construction documents have been approved by a school district board of trustees, or a board's authorized representative, on or after January 1, 2004.

Specialized Classrooms – The following provisions shall apply to combination science laboratories/classrooms, where each student has a lab station and where typically there is a clearly defined laboratory area and a clearly defined lecture area.

- Combination science laboratories/classrooms shall have a minimum of 900 square feet per room at the **elementary** school level. The minimum room size is adequate for 22 students; 41 square feet per student shall be added to the minimum square footage for each student in excess of 22.

- Combination science laboratories/classrooms shall have a minimum of 1,200 square feet per room at the **middle** school level. The minimum room size is adequate for 24 students; 50 square feet per student shall be added to the minimum square footage for each student in excess of 24.
- Combination science laboratories/classrooms shall have a minimum of 1,400 square feet per room at the **high** school level. The minimum room size is adequate for 24 students; 58 square feet per student shall be added to the minimum square footage for each student in excess of 24.

For districts that choose to use separate science classrooms and science laboratories, the following provisions shall apply:

- A science classroom shall be a minimum of 700 square feet regardless of grade level served.
- A science laboratory shall have a minimum of 800 square feet at the elementary school level. The minimum laboratory size is adequate for 22 students; 36 square feet per student shall be added to the minimum square footage for each student in excess of 22.
- A science laboratory shall have a minimum of 900 square feet at the middle school level. The minimum laboratory size is adequate for 24 students; 38 square feet per student shall be added to the minimum square footage for each student in excess of 24.
- A science laboratory shall have a minimum of 1,000 square feet at the high school level. The minimum laboratory size is adequate for 24 students; 42 square feet per student shall be added to the minimum square footage for each student in excess of 24.
- Science classrooms shall be provided at a ratio not to exceed 2:1 of science classrooms to science laboratories at the middle school and high school levels. The science laboratories shall be located convenient to the science classrooms they serve.

The complete Commissioner's Rules Concerning School Facilities is located at http://ritter.tea.state.tx.us/rules/tac/chapter061/ch61cc.html.

10. Where is information available for building science laboratories?

Detailed information on building new science laboratories, or renovating old science laboratories, is provided in the *Texas Facilities Standards*. In addition, information on constructing outdoor science learning facilities for your school may be found in this document. This document will be posted soon on the science curriculum website.

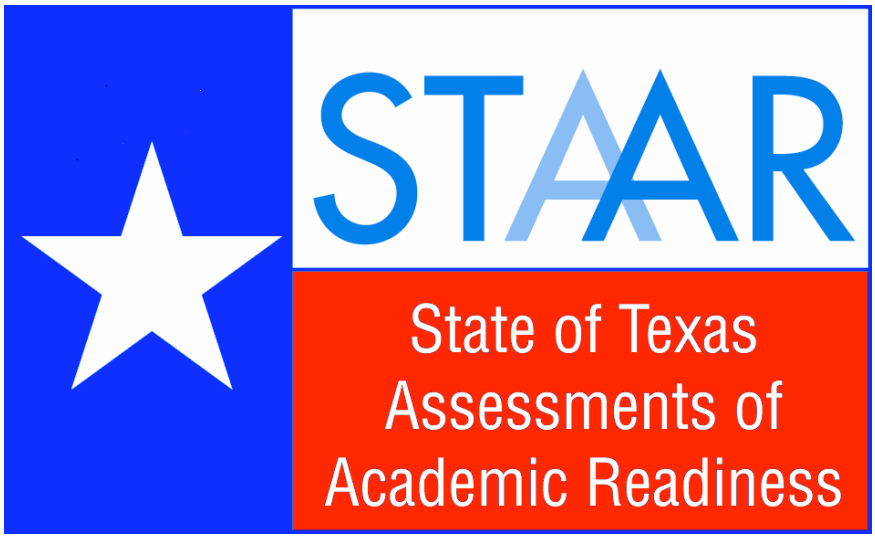
11. Can a school charge students "lab fees" to cover the cost of materials used in the science classroom or place items such as safety goggles on the student supply list?

No. A district must have statutory authorization to charge a fee. Texas Education Code (TEC) §11.158 is where most allowed fees are delineated. Specifically TEC §11.158(b)(1) prohibits fees for "textbooks, workbooks, laboratory supplies, or other supplies necessary for participation in any instructional course . . . ." There are some exceptions (band instrument rentals, for example), but they do not apply in this instance.

12. Do demonstrations, simulations and web explorations count as labs in regard to the 40% lab time requirement?

Scientists across the state and nation have noted the growing use of computer generated data collection and investigation. Computer software, hardware, and online instructional resources are now an integral part of most science classes. Students enjoy and can gain knowledge from the use of computers in science. It is appropriate to include some level of simulations and computer generated laboratory experiences as science laboratory time. It is important, however, that these simulations, demonstrations, and two dimensional laboratory experiences do not dominate the student experience in science. The very nature of science warrants student manipulation of equipment, earth materials and organisms that engage all of the student's senses in a way that no computer program can simulate. Demonstrations, simulations, and web explorations can be considered part of the 40% lab requirements if they incorporate active learning and engagement. Schools should carefully consider the portion of the 40% lab requirement that is made up of such activities.

STAAR Grade 5 Resources



Grade 5 Science Assessment

Eligible Texas Essential Knowledge and Skills

Texas Education Agency
Student Assessment Division
Fall 2010

STAAR Grade 5 Science Assessment

Reporting Category 1: Matter and Energy

The student will demonstrate an understanding of the properties of matter and energy and their interactions.

Grade 5

(5.5) **Matter and energy.** The student knows that matter has measurable physical properties and those properties determine how matter is classified, changed, and used. The student is expected to

(A) classify matter based on physical properties, including mass, magnetism, physical state (solid, liquid, and gas), relative density (sinking and floating), solubility in water, and the ability to conduct or insulate thermal energy or electric energy; ***Readiness Standard***

(B) identify the boiling and freezing/melting points of water on the Celsius scale; ***Supporting Standard***

(C) demonstrate that some mixtures maintain physical properties of their ingredients such as iron filings and sand; and ***Supporting Standard***

(D) identify changes that can occur in the physical properties of the ingredients of solutions such as dissolving salt in water or adding lemon juice to water. ***Supporting Standard***

Grade 3

(3.5) **Matter and energy.** The student knows that matter has measurable physical properties and those properties determine how matter is classified, changed, and used. The student is expected to

(C) predict, observe, and record changes in the state of matter caused by heating or cooling. ***Supporting Standard***

Texas Education Agency
Student Assessment Division
Fall 2010

Reporting Category 2:
Force, Motion, and Energy

The student will demonstrate an understanding of force, motion, and energy and their relationships.

Grade 5

(5.6) **Force, motion, and energy.** The student knows that energy occurs in many forms and can be observed in cycles, patterns, and systems. The student is expected to

(A) explore the uses of energy, including mechanical, light, thermal, electrical, and sound energy; ***Readiness Standard***

(B) demonstrate that the flow of electricity in circuits requires a complete path through which an electric current can pass and can produce light, heat, and sound; ***Readiness Standard***

(C) demonstrate that light travels in a straight line until it strikes an object or travels through one medium to another and demonstrate that light can be reflected such as the use of mirrors or other shiny surfaces and refracted such as the appearance of an object when observed through water; and ***Readiness Standard***

(D) design an experiment that tests the effect of force on an object. ***Supporting Standard***

Grade 3

(3.6) **Force, motion, and energy.** The student knows that forces cause change and that energy exists in many forms. The student is expected to

(B) demonstrate and observe how position and motion can be changed by pushing and pulling objects to show work being done such as swings, balls, pulleys, and wagons. ***Supporting Standard***

Texas Education Agency
Student Assessment Division
Fall 2010

Reporting Category 3:
Earth and Space

The student will demonstrate an understanding of components, cycles, patterns, and natural events of Earth and space systems.

Grade 5

(5.7) **Earth and space.** The student knows Earth's surface is constantly changing and consists of useful resources. The student is expected to

(A) explore the processes that led to the formation of sedimentary rocks and fossil fuels; ***Readiness Standard***

(B) recognize how landforms such as deltas, canyons, and sand dunes are the result of changes to Earth's surface by wind, water, and ice; ***Readiness Standard***

(C) identify alternative energy resources such as wind, solar, hydroelectric, geothermal, and biofuels; and ***Readiness Standard***

(D) identify fossils as evidence of past living organisms and the nature of the environments at the time using models. ***Supporting Standard***

(5.8) **Earth and space.** The student knows that there are recognizable patterns in the natural world and among the Sun, Earth, and Moon system. The student is expected to

(A) differentiate between weather and climate; ***Supporting Standard***

(B) explain how the Sun and the ocean interact in the water cycle; ***Supporting Standard***

(C) demonstrate that Earth rotates on its axis once approximately every 24 hours causing the day/night cycle and the apparent movement of the Sun across the sky; and ***Readiness Standard***

(D) identify and compare the physical characteristics of the Sun, Earth, and Moon. ***Supporting Standard***

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Grade 4

(4.7) **Earth and space.** The student knows that Earth consists of useful resources and its surface is constantly changing. The student is expected to

(A) examine properties of soils, including color and texture, capacity to retain water, and ability to support the growth of plants; and ***Supporting Standard***

(C) identify and classify Earth's renewable resources, including air, plants, water, and animals; and nonrenewable resources, including coal, oil, and natural gas; and the importance of conservation. ***Supporting Standard***

(4.8) **Earth and space.** The student knows that there are recognizable patterns in the natural world and among the Sun, Earth, and Moon system. The student is expected to

(A) measure and record changes in weather and make predictions using weather maps, weather symbols, and a map key; ***Supporting Standard***

(B) describe and illustrate the continuous movement of water above and on the surface of Earth through the water cycle and explain the role of the Sun as a major source of energy in this process; and ***Supporting Standard***

(C) collect and analyze data to identify sequences and predict patterns of change in shadows, tides, seasons, and the observable appearance of the Moon over time. ***Supporting Standard***

Grade 3

(3.7) **Earth and space.** The student knows that Earth consists of natural resources and its surface is constantly changing. The student is expected to

(B) investigate rapid changes in Earth's surface such as volcanic eruptions, earthquakes, and landslides. ***Supporting Standard***

(3.8) **Earth and space.** The student knows there are recognizable patterns in the natural world and among objects in the sky. The student is expected to

(D) identify the planets in Earth's solar system and their position in relation to the Sun. ***Supporting Standard***

Texas Education Agency
Student Assessment Division
Fall 2010

Reporting Category 4:
Organisms and Environments

The student will demonstrate an understanding of the structures and functions of living organisms and their interdependence on each other and on their environment.

Grade 5

(5.9) **Organisms and environments.** The student knows that there are relationships, systems, and cycles within environments. The student is expected to

(A) observe the way organisms live and survive in their ecosystem by interacting with the living and non-living elements; ***Readiness Standard***

(B) describe how the flow of energy derived from the Sun, used by producers to create their own food, is transferred through a food chain and food web to consumers and decomposers; ***Readiness Standard***

(C) predict the effects of changes in ecosystems caused by living organisms, including humans, such as the overpopulation of grazers or the building of highways; and ***Supporting Standard***

(D) identify the significance of the carbon dioxide-oxygen cycle to the survival of plants and animals. ***Supporting Standard***

(5.10) **Organisms and environments.** The student knows that organisms undergo similar life processes and have structures that help them survive within their environments. The student is expected to

(A) compare the structures and functions of different species that help them live and survive such as hooves on prairie animals or webbed feet in aquatic animals; ***Readiness Standard***

(B) differentiate between inherited traits of plants and animals such as spines on a cactus or shape of a beak and learned behaviors such as an animal learning tricks or a child riding a bicycle; and ***Readiness Standard***

(C) describe the differences between complete and incomplete metamorphosis of insects. ***Supporting Standard***

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Grade 3

(3.9) **Organisms and environments.** The student knows that organisms have characteristics that help them survive and can describe patterns, cycles, systems, and relationships within the environments. The student is expected to

(A) observe and describe the physical characteristics of environments and how they support populations and communities within an ecosystem. ***Supporting Standard***

(3.10) **Organisms and environments.** The student knows that organisms undergo similar life processes and have structures that help them survive within their environments. The student is expected to

(C) investigate and compare how animals and plants undergo a series of orderly changes in their diverse life cycles such as tomato plants, frogs, and lady bugs. ***Supporting Standard***

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Fall 2010

Scientific Investigation and Reasoning Skills

These skills will not be listed under a separate reporting category. Instead, they will be incorporated into at least 40% of the test questions in reporting categories 1–4 and will be identified along with content standards.

Grade 5

(5.1) **Scientific investigation and reasoning.** The student conducts classroom and outdoor investigations following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to

(A) demonstrate safe practices and the use of safety equipment as described in the Texas Safety Standards during classroom and outdoor investigations; and

(B) make informed choices in the conservation, disposal, and recycling of materials.

(5.2) **Scientific investigation and reasoning.** The student uses scientific methods during laboratory and outdoor investigations. The student is expected to

(A) describe, plan, and implement simple experimental investigations testing one variable;

(B) ask well-defined questions, formulate testable hypotheses, and select and use appropriate equipment and technology;

(C) collect information by detailed observations and accurate measuring;

(D) analyze and interpret information to construct reasonable explanations from direct (observable) and indirect (inferred) evidence;

(E) demonstrate that repeated investigations may increase the reliability of results;

(F) communicate valid conclusions in [both] written [and verbal] form[s]; and

(G) construct appropriate simple graphs, tables, maps, and charts using technology, including computers, to organize, examine, and evaluate information.

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

(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

(B) evaluate the accuracy of the information related to promotional materials for products and services such as nutritional labels;

(C) draw or develop a model that represents how something works or looks that cannot be seen such as how a soda dispensing machine works; and

(D) connect grade-level appropriate science concepts with the history of science, science careers, and contributions of scientists.

(5.4) **Scientific investigation and reasoning.** 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 calculators, microscopes, cameras, computers, hand lenses, metric rulers, Celsius thermometers, prisms, mirrors, pan balances, triple beam balances, spring scales, graduated cylinders, beakers, hot plates, meter sticks, magnets, collecting nets, and notebooks; timing devices, including clocks and stopwatches; and materials to support observations of habitats or organisms such as terrariums and aquariums; and

(B) use safety equipment, including safety goggles and gloves.

Texas Education Agency
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Fall 2010

STAAR Grade 5 Science Blueprint

Scientific Investigation and Reasoning Skills is not a separate reporting category. These skills will be incorporated into at least 40% of the test questions from reporting categories 1–4 and will be identified along with the content standards.				
Reporting Categories	**Number of Standards**		**Number of Questions**	
Reporting Category 1: Matter and Energy	Readiness Standards	1	**8**	
	Supporting Standards	4		
	Total	5		
Reporting Category 2: Force, Motion, and Energy	Readiness Standards	3	**10**	
	Supporting Standards	2		
	Total	5		
Reporting Category 3: Earth and Space	Readiness Standards	4	**12**	
	Supporting Standards	11		
	Total	15		
Reporting Category 4: Organisms and Environments	Readiness Standards	4	**14**	
	Supporting Standards	5		
	Total	9		
Readiness Standards	**Total Number of Standards**	**12**	**60%–65%**	**26–29**
Supporting Standards	**Total Number of Standards**	**22**	**35%–40%**	**15–18**
Total Number of Questions on Test			**43 Multiple Choice 1 Griddable 44 Total**	

STAAR™ Grade 5 Science Assessment – Quick Reference Chart

Reporting Category 1: Matter and Energy – Student Expectations (8 questions of 44 total)

Readiness Standards	Supporting Standards
5.5A	5.5B
	5.5C
	5.5D
	3.5C

Reporting Category 2: Force, Motion, and Energy – Student Expectations (10 questions of 44 total)

Readiness Standards	Supporting Standards
5.6A	5.6D
5.6B	3.6B
5.6C	

Reporting Category 3: Earth and Space – Student Expectations (12 questions of 44 total)

Readiness Standards	Supporting Standards
5.7A	5.7D
5.7B	5.8A
5.7C	5.8B
5.8C	5.8D
	4.7A
	4.7C
	4.8A
	4.8B
	4.8C
	3.7B
	3.8D

Reporting Category 4: Organisms and Environments – Student Expectations (14 questions of 44 total)

Readiness Standards	Supporting Standards
5.9A	5.9C
5.9B	5.9D
5.10A	5.10C
5.10B	3.9A
	3.10C

Scientific Investigation and Reasoning Skills

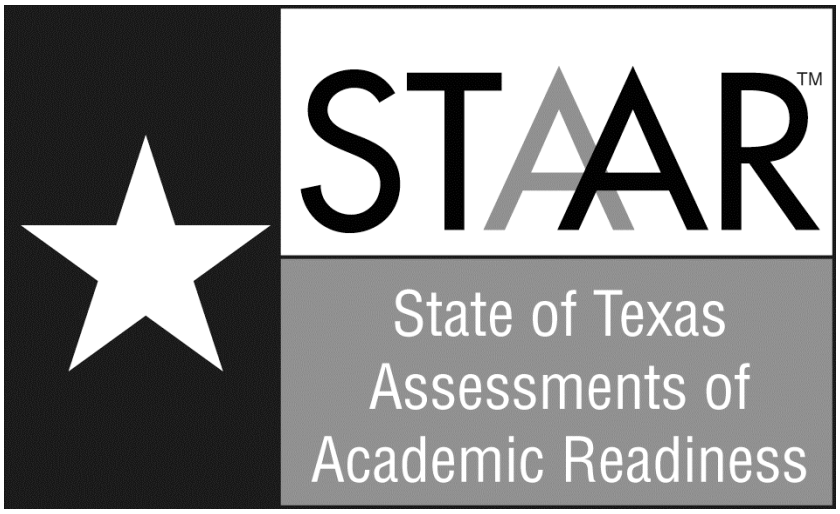
These skills will not be listed under a separate reporting category. Instead, they will be incorporated into at least 40% of the test questions in reporting categories 1–4 and will be identified along with content standards.

Grade 5 Student Expectations
5.1A, 5.1B
5.2A, 5.2B, 5.2C, 5.2D, 5.2E, 5.2F, 5.2G
5.3A, 5.3B, 5.3C, 5.3D
5.4A, 5.4B

Total Number of Readiness Standards = 12	60%–65% of Test (between 26-29 questions on test)
Total Number of Supporting Standards = 22	35%–40% of Test (between 15-18 questions on test)
Total Number of Questions = 44 (43 Multiple Choice and 1 Griddable)	

Information excerpted from http://www.tea.state.tx.us/student.assessment/staar/

STAAR Grade 8 Resources



Grade 8 Science Assessment

Eligible Texas Essential Knowledge and Skills

Texas Education Agency
Student Assessment Division
Fall 2010

STAAR Grade 8 Science Assessment

Reporting Category 1: Matter and Energy

The student will demonstrate an understanding of the properties of matter and energy and their interactions.

Grade 8

(8.5) **Matter and energy.** The student knows that matter is composed of atoms and has chemical and physical properties. The student is expected to

(A) describe the structure of atoms, including the masses, electrical charges, and locations, of protons and neutrons in the nucleus and electrons in the electron cloud; ***Readiness Standard***

(B) identify that protons determine an element's identity and valence electrons determine its chemical properties, including reactivity; ***Readiness Standard***

(C) interpret the arrangement of the Periodic Table, including groups and periods, to explain how properties are used to classify elements; ***Readiness Standard***

(D) recognize that chemical formulas are used to identify substances and determine the number of atoms of each element in chemical formulas containing subscripts; ***Readiness Standard***

(E) investigate how evidence of chemical reactions indicate that new substances with different properties are formed; and ***Readiness Standard***

(F) recognize whether a chemical equation containing coefficients is balanced or not and how that relates to the law of conservation of mass. ***Supporting Standard***

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Grade 7

(7.5) **Matter and energy.** The student knows that interactions occur between matter and energy. The student is expected to

(C) diagram the flow of energy through living systems, including food chains, food webs, and energy pyramids. ***Supporting Standard***

(7.6) **Matter and energy.** The student knows that matter has physical and chemical properties and can undergo physical and chemical changes. The student is expected to

(A) identify that organic compounds contain carbon and other elements such as hydrogen, oxygen, phosphorus, nitrogen, or sulfur; and ***Supporting Standard***

(B) distinguish between physical and chemical changes in matter in the digestive system. ***Supporting Standard***

Grade 6

(6.5) **Matter and energy.** The student knows the differences between elements and compounds. The student is expected to

(C) differentiate between elements and compounds on the most basic level. ***Supporting Standard***

(6.6) **Matter and energy.** The student knows matter has physical properties that can be used for classification. The student is expected to

(A) compare metals, nonmetals, and metalloids using physical properties such as luster, conductivity, or malleability; and ***Supporting Standard***

(B) calculate density to identify an unknown substance. ***Supporting Standard***

Reporting Category 2:
Force, Motion, and Energy

The student will demonstrate an understanding of force, motion, and energy and their relationships.

Grade 8

(8.6) **Force, motion, and energy.** The student knows that there is a relationship between force, motion, and energy. The student is expected to

(A) demonstrate and calculate how unbalanced forces change the speed or direction of an object's motion;
Readiness Standard

(B) differentiate between speed, velocity, and acceleration; and
Supporting Standard

(C) investigate and describe applications of Newton's law of inertia, law of force and acceleration, and law of action-reaction such as in vehicle restraints, sports activities, amusement park rides, Earth's tectonic activities, and rocket launches. ***Readiness Standard***

Grade 7

(7.7) **Force, motion, and energy.** The student knows that there is a relationship among force, motion, and energy. The student is expected to

(A) contrast situations where work is done with different amounts of force to situations where no work is done such as moving a box with a ramp and without a ramp, or standing still.
Supporting Standard

Grade 6

(6.8) **Force, motion, and energy.** The student knows force and motion are related to potential and kinetic energy. The student is expected to

(A) compare and contrast potential and kinetic energy;
Supporting Standard

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(C) calculate average speed using distance and time measurements; and ***Supporting Standard***

(D) measure and graph changes in motion. ***Supporting Standard***

(6.9) **Force, motion, and energy.** The student knows that the Law of Conservation of Energy states that energy can neither be created nor destroyed, it just changes form. The student is expected to

(C) demonstrate energy transformations such as energy in a flashlight battery changes from chemical energy to electrical energy to light energy. ***Supporting Standard***

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Reporting Category 3:
Earth and Space

The student will demonstrate an understanding of components, cycles, patterns, and natural events of Earth and space systems.

Grade 8

(8.7) **Earth and space.** The student knows the effects resulting from cyclical movements of the Sun, Earth, and Moon. The student is expected to

(A) model and illustrate how the tilted Earth rotates on its axis, causing day and night, and revolves around the Sun causing changes in seasons; ***Readiness Standard***

(B) demonstrate and predict the sequence of events in the lunar cycle; and ***Readiness Standard***

(C) relate the position of the Moon and Sun to their effect on ocean tides. ***Supporting Standard***

(8.8) **Earth and space.** The student knows characteristics of the universe. The student is expected to

(A) describe components of the universe, including stars, nebulae, and galaxies, and use models such as the Hertzsprung-Russell diagram for classification; ***Readiness Standard***

(B) recognize that the Sun is a medium-sized star near the edge of a disc-shaped galaxy of stars and that the Sun is many thousands of times closer to Earth than any other star; ***Supporting Standard***

(C) explore how different wavelengths of the electromagnetic spectrum such as light and radio waves are used to gain information about distances and properties of components in the universe; and ***Supporting Standard***

(D) model and describe how light years are used to measure distances and sizes in the universe. ***Supporting Standard***

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(8.9) **Earth and space.** The student knows that natural events can impact Earth systems. The student is expected to

(A) describe the historical development of evidence that supports plate tectonic theory; ***Supporting Standard***

(B) relate plate tectonics to the formation of crustal features; and ***Readiness Standard***

(C) interpret topographic maps and satellite views to identify land and erosional features and predict how these features may be reshaped by weathering. ***Readiness Standard***

(8.10) **Earth and space.** The student knows that climatic interactions exist among Earth, ocean, and weather systems. The student is expected to

(A) recognize that the Sun provides the energy that drives convection within the atmosphere and oceans, producing winds and ocean currents; ***Supporting Standard***

(B) identify how global patterns of atmospheric movement influence local weather using weather maps that show high and low pressures and fronts; and ***Supporting Standard***

(C) identify the role of the oceans in the formation of weather systems such as hurricanes. ***Supporting Standard***

Grade 7

(7.8) **Earth and space.** The student knows that natural events and human activity can impact Earth systems. The student is expected to

(C) model the effects of human activity on groundwater and surface water in a watershed. ***Supporting Standard***

Grade 6

(6.11) **Earth and space.** The student understands the organization of our solar system and the relationships among the various bodies that comprise it. The student is expected to

(B) understand that gravity is the force that governs the motion of our solar system. ***Supporting Standard***

Reporting Category 4:
Organisms and Environments

The student will demonstrate an understanding of the structures and functions of living organisms and their interdependence on each other and on their environment.

Grade 8

(8.11) **Organisms and environments.** The student knows that interdependence occurs among living systems and the environment and that human activities can affect these systems. The student is expected to

(A) describe producer/consumer, predator/prey, and parasite/host relationships as they occur in food webs within marine, freshwater, and terrestrial ecosystems; ***Readiness Standard***

(B) investigate how organisms and populations in an ecosystem depend on and may compete for biotic and abiotic factors such as quantity of light, water, range of temperatures, or soil composition; ***Readiness Standard***

(C) explore how short- and long-term environmental changes affect organisms and traits in subsequent populations; and ***Readiness Standard***

(D) recognize human dependence on ocean systems and explain how human activities such as runoff, artificial reefs, or use of resources have modified these systems. ***Supporting Standard***

Grade 7

(7.10) **Organisms and environments**. The student knows that there is a relationship between organisms and the environment. The student is expected to

(B) describe how biodiversity contributes to the sustainability of an ecosystem; and ***Supporting Standard***

(C) observe, record, and describe the role of ecological succession such as in a microhabitat of a garden with weeds. ***Supporting Standard***

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(7.11) **Organisms and environments.** The student knows that populations and species demonstrate variation and inherit many of their unique traits through gradual processes over many generations. The student is expected to

(A) examine organisms or their structures such as insects or leaves and use dichotomous keys for identification; and ***Supporting Standard***

(C) identify some changes in genetic traits that have occurred over several generations through natural selection and selective breeding such as the Galapagos Medium Ground Finch (*Geospiza fortis*) or domestic animals.
Supporting Standard

(7.12) **Organisms and environments.** The student knows that living systems at all levels of organization demonstrate the complementary nature of structure and function. The student is expected to

(B) identify the main functions of the systems of the human organism, including the circulatory, respiratory, skeletal, muscular, digestive, excretory, reproductive, integumentary, nervous, and endocrine systems; ***Supporting Standard***

(D) differentiate between structure and function in plant and animal cell organelles, including cell membrane, cell wall, nucleus, cytoplasm, mitochondrion, chloroplast, and vacuole; and
Supporting Standard

(F) recognize that according to cell theory all organisms are composed of cells and cells carry on similar functions such as extracting energy from food to sustain life.
Supporting Standard

(7.14) **Organisms and environments.** The student knows that reproduction is a characteristic of living organisms and that the instructions for traits are governed in the genetic material. The student is expected to

(B) compare the results of uniform or diverse offspring from sexual reproduction or asexual reproduction; and
Supporting Standard

(C) recognize that inherited traits of individuals are governed in the genetic material found in the genes within chromosomes in the nucleus. ***Supporting Standard***

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Grade 6

(6.12) **Organisms and environments.** The student knows all organisms are classified into Domains and Kingdoms. Organisms within these taxonomic groups share similar characteristics which allow them to interact with the living and nonliving parts of their ecosystem. The student is expected to

(D) identify the basic characteristics of organisms, including prokaryotic or eukaryotic, unicellular or multicellular, autotrophic or heterotrophic, and mode of reproduction, that further classify them in the currently recognized Kingdoms. ***Supporting Standard***

Scientific Investigation and Reasoning Skills

These skills will not be listed under a separate reporting category. Instead, they will be incorporated into at least 40% of the test questions in reporting categories 1–4 and will be identified along with content standards.

Grade 8

(8.1) **Scientific investigation and reasoning.** The student, for at least 40% of instructional time, conduct laboratory and field investigations following safety procedures and environmentally appropriate and ethical practices. The student is expected to

(A) demonstrate safe practices during laboratory and field investigations as outlined in the Texas Safety Standards; and

(B) practice appropriate use and conservation of resources, including disposal, reuse, or recycling of materials.

(8.2) **Scientific investigation and reasoning.** The student uses scientific inquiry methods during laboratory and field investigations. The student is expected to

(A) plan and implement comparative and descriptive investigations by making observations, asking well-defined questions, and using appropriate equipment and technology;

(B) design and implement comparative and experimental investigations by making observations, asking well-defined questions, formulating testable hypotheses, and using appropriate equipment and technology;

(C) collect and record data using the International System of Units (SI) and qualitative means such as labeled drawings, writing, and graphic organizers;

(D) construct tables and graphs, using repeated trials and means, to organize data and identify patterns; and

(E) analyze data to formulate reasonable explanations, communicate valid conclusions supported by the data, and predict trends.

(8.3) **Scientific investigation and reasoning.** The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions and know the contributions of relevant scientists. The student is expected to

(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

(B) use models to represent aspects of the natural world such as an atom, a molecule, space, or a geologic feature;

(C) identify advantages and limitations of models such as size, scale, properties, and materials; and

(D) relate the impact of research on scientific thought and society, including the history of science and contributions of scientists as related to the content.

(8.4) **Scientific investigation and reasoning.** The student knows how to use a variety of tools and safety equipment to conduct science inquiry. The student is expected to

(A) use appropriate tools to collect, record, and analyze information, including lab journals/notebooks, beakers, meter sticks, graduated cylinders, anemometers, psychrometers, hot plates, test tubes, spring scales, balances, microscopes, thermometers, calculators, computers, spectroscopes, timing devices, and other equipment as needed to teach the curriculum; and

(B) use preventative safety equipment, including chemical splash goggles, aprons, and gloves, and be prepared to use emergency safety equipment, including an eye/face wash, a fire blanket, and a fire extinguisher.

STAAR Grade 8 Science Blueprint

Scientific Investigation and Reasoning Skills is not a separate reporting category. These skills will be incorporated into at least 40% of the test questions from reporting categories 1–4 and will be identified along with the content standards.				
Reporting Categories	**Number of Standards**		**Number of Questions**	
Reporting Category 1: Matter and Energy	Readiness Standards	5	**14**	
	Supporting Standards	7		
	Total	12		
Reporting Category 2: Force, Motion, and Energy	Readiness Standards	2	**12**	
	Supporting Standards	6		
	Total	8		
Reporting Category 3: Earth and Space	Readiness Standards	5	**14**	
	Supporting Standards	10		
	Total	15		
Reporting Category 4: Organisms and Environments	Readiness Standards	3	**14**	
	Supporting Standards	11		
	Total	14		
Readiness Standards	**Total Number of Standards**	**15**	**60%–65%**	**32–35**
Supporting Standards	**Total Number of Standards**	**34**	**35%–40%**	**19–22**
Total Number of Questions on Test			**50 Multiple Choice 4 Griddable 54 Total**	

STAAR™ Grade 8 Science Assessment – Quick Reference Chart

Reporting Category 1: Matter and Energy – Student Expectations (14 questions of 54 total)

Readiness Standards	Supporting Standards
8.5A	8.5F
8.5B	7.5C
8.5C	7.6A
8.5D	7.6B
8.5E	6.5C
	6.6A
	6.6B

Reporting Category 2: Force, Motion, and Energy – Student Expectations (12 questions of 54 total)

Readiness Standards	Supporting Standards
8.6A	8.6B
8.6C	7.7A
	6.8A
	6.8C
	6.8D
	6.9C

Reporting Category 3: Earth and Space – Student Expectations (14 questions of 54 total)

Readiness Standards	Supporting Standards
8.7A	8.7C
8.7B	8.8B
8.8A	8.8C
8.9B	8.8D
8.9C	8.9A
	8.10A
	8.10B
	8.10C
	7.8C
	6.11B

Reporting Category 4: Organisms and Environments – Student Expectations (14 questions of 54 total)

Readiness Standards	Supporting Standards
8.11A	8.11D
8.11B	7.10B
8.11C	7.10C
	7.11A
	7.11C
	7.12B
	7.12D
	7.12F
	7.14B
	7.14C
	6.12D

Scientific Investigation and Reasoning Skills

These skills will not be listed under a separate reporting category. Instead, they will be incorporated into at least 40% of the test questions in reporting categories 1–4 and will be identified along with content standards.

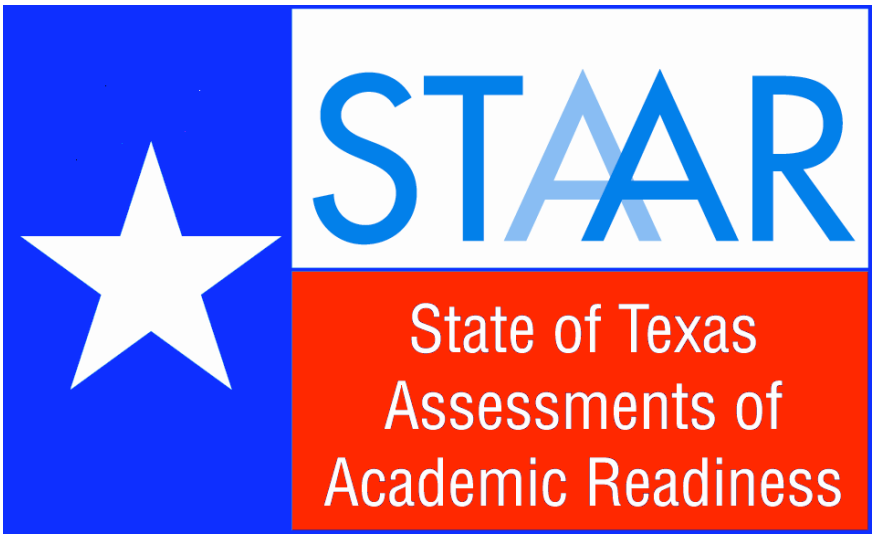
Grade 8 Student Expectations
8.1A, 8.1B
8.2A, 8.2B, 8.2C, 8.2D, 8.2E
8.3A, 8.3B, 8.3C, 8.3D
8.4A, 8.4B

Total Number of Readiness Standards = 15	60%–65% of Test (between 32-35 questions on test)
Total Number of Supporting Standards = 34	35%–40% of Test (between 19-22 questions on test)

Total Number of Questions = 54 (50 Multiple Choice and 4 Griddable)

Information excerpted from http://www.tea.state.tx.us/student.assessment/staar/

STAAR Biology Resources



Biology Assessment

Eligible Texas Essential Knowledge and Skills

Texas Education Agency
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Fall 2010

STAAR Biology Assessment

Reporting Category 1: Cell Structure and Function

The student will demonstrate an understanding of biomolecules as building blocks of cells, and that cells are the basic unit of structure and function of living things.

(B.4) **Science concepts.** The student knows that cells are the basic structures of all living things with specialized parts that perform specific functions and that viruses are different from cells. The student is expected to

(A) compare and contrast prokaryotic and eukaryotic cells; ***Supporting Standard***

(B) investigate and explain cellular processes, including homeostasis, energy conversions, transport of molecules, and synthesis of new molecules; and ***Readiness Standard***

(C) compare the structures of viruses to cells, describe viral reproduction, and describe the role of viruses in causing diseases such as human immunodeficiency virus (HIV) and influenza. ***Readiness Standard***

(B.5) **Science concepts.** The student knows how an organism grows and the importance of cell differentiation. The student is expected to

(A) describe the stages of the cell cycle, including deoxyribonucleic acid (DNA) replication and mitosis, and the importance of the cell cycle to the growth of organisms; ***Readiness Standard***

(B) examine specialized cells, including roots, stems, and leaves of plants; and animal cells such as blood, muscle, and epithelium; ***Supporting Standard***

(C) describe the roles of DNA, ribonucleic acid (RNA), and environmental factors in cell differentiation; and ***Supporting Standard***

(D) recognize that disruptions of the cell cycle lead to diseases such as cancer. ***Supporting Standard***

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(B.9) **Science concepts.** The student knows the significance of various molecules involved in metabolic processes and energy conversions that occur in living organisms. The student is expected to

(A) compare the structures and functions of different types of biomolecules, including carbohydrates, lipids, proteins, and nucleic acids; and ***Readiness Standard***

(D) analyze and evaluate the evidence regarding formation of simple organic molecules and their organization into long complex molecules having information such as the DNA molecule for self-replicating life. ***Supporting Standard***

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Reporting Category 2:
Mechanisms of Genetics

The student will demonstrate an understanding of the mechanisms of genetics.

(B.6) **Science concepts.** The student knows the mechanisms of genetics, including the role of nucleic acids and the principles of Mendelian Genetics. The student is expected to

(A) identify components of DNA, and describe how information for specifying the traits of an organism is carried in the DNA; ***Readiness Standard***

(B) recognize that components that make up the genetic code are common to all organisms; ***Supporting Standard***

(C) explain the purpose and process of transcription and translation using models of DNA and RNA; ***Supporting Standard***

(D) recognize that gene expression is a regulated process; ***Supporting Standard***

(E) identify and illustrate changes in DNA and evaluate the significance of these changes; ***Readiness Standard***

(F) predict possible outcomes of various genetic combinations such as monohybrid crosses, dihybrid crosses and non-Mendelian inheritance; ***Readiness Standard***

(G) recognize the significance of meiosis to sexual reproduction; and ***Supporting Standard***

(H) describe how techniques such as DNA fingerprinting, genetic modifications, and chromosomal analysis are used to study the genomes of organisms. ***Supporting Standard***

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Fall 2010

Reporting Category 3:
Biological Evolution and Classification

The student will demonstrate an understanding of the theory of biological evolution and the hierarchical classification of organisms.

(B.7) **Science concepts.** The student knows evolutionary theory is a scientific explanation for the unity and diversity of life. The student is expected to

(A) analyze and evaluate how evidence of common ancestry among groups is provided by the fossil record, biogeography, and homologies, including anatomical, molecular, and developmental; ***Readiness Standard***

(B) analyze and evaluate scientific explanations concerning any data of sudden appearance, stasis, and sequential nature of groups in the fossil record; ***Supporting Standard***

(C) analyze and evaluate how natural selection produces change in populations, not individuals; ***Supporting Standard***

(D) analyze and evaluate how the elements of natural selection, including inherited variation, the potential of a population to produce more offspring than can survive, and a finite supply of environmental resources, result in differential reproductive success; ***Supporting Standard***

(E) analyze and evaluate the relationship of natural selection to adaptation and to the development of diversity in and among species; ***Readiness Standard***

(F) analyze and evaluate the effects of other evolutionary mechanisms, including genetic drift, gene flow, mutation, and recombination; and ***Supporting Standard***

(G) analyze and evaluate scientific explanations concerning the complexity of the cell. ***Supporting Standard***

(B.8) **Science concepts.** The student knows that taxonomy is a branching classification based on the shared characteristics of organisms and can change as new discoveries are made. The student is expected to

(A) define taxonomy and recognize the importance of a standardized taxonomic system to the scientific community; ***Supporting Standard***

(B) categorize organisms using a hierarchical classification system based on similarities and differences shared among groups; and ***Readiness Standard***

(C) compare characteristics of taxonomic groups, including archaea, bacteria, protists, fungi, plants, and animals. ***Supporting Standard***

Reporting Category 4:
Biological Processes and Systems

The student will demonstrate an understanding of metabolic processes, energy conversions, and interactions and functions of systems in organisms.

(B.9) **Science concepts.** The student knows the significance of various molecules involved in metabolic processes and energy conversions that occur in living organisms. The student is expected to

(B) compare the reactants and products of photosynthesis and cellular respiration in terms of energy and matter; and ***Supporting Standard***

(C) identify and investigate the role of enzymes. ***Supporting Standard***

(B.10) **Science concepts.** The student knows that biological systems are composed of multiple levels. The student is expected to

(A) describe the interactions that occur among systems that perform the functions of regulation, nutrient absorption, reproduction, and defense from injury or illness in animals; ***Readiness Standard***

(B) describe the interactions that occur among systems that perform the functions of transport, reproduction, and response in plants; and ***Readiness Standard***

(C) analyze the levels of organization in biological systems and relate the levels to each other and to the whole system. ***Supporting Standard***

(B.11) **Science concepts.** The student knows that biological systems work to achieve and maintain balance. The student is expected to

(A) describe the role of internal feedback mechanisms in the maintenance of homeostasis. ***Supporting Standard***

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Reporting Category 5:
Interdependence within Environmental Systems

The student will demonstrate an understanding of the interdependence and interactions that occur within an environmental system and their significance.

(B.11) **Science concepts.** The student knows that biological systems work to achieve and maintain balance. The student is expected to

(B) investigate and analyze how organisms, populations, and communities respond to external factors; ***Supporting Standard***

(C) summarize the role of microorganisms in both maintaining and disrupting the health of both organisms and ecosystems; and ***Supporting Standard***

(D) describe how events and processes that occur during ecological succession can change populations and species diversity. ***Readiness Standard***

(B.12) **Science concepts.** The student knows that interdependence and interactions occur within an environmental system. The student is expected to

(A) interpret relationships, including predation, parasitism, commensalism, mutualism, and competition among organisms; ***Readiness Standard***

(B) compare variations and adaptations of organisms in different ecosystems; ***Supporting Standard***

(C) analyze the flow of matter and energy through trophic levels using various models, including food chains, food webs, and ecological pyramids; ***Readiness Standard***

(D) recognize that long-term survival of species is dependent on changing resource bases that are limited; ***Supporting Standard***

(E) describe the flow of matter through the carbon and nitrogen cycles and explain the consequences of disrupting these cycles; and ***Supporting Standard***

(F) describe how environmental change can impact ecosystem stability. ***Readiness Standard***

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Student Assessment Division
Fall 2010

Scientific Process Skills

These skills will not be listed under a separate reporting category. Instead, they will be incorporated into at least 40% of the test questions from reporting categories 1–5 and will be identified along with content standards.

(B.1) **Scientific processes.** The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to

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

(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.

(B.2) **Scientific processes.** The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to

(A) know the definition of science and understand that it has limitations, as specified in chapter 112.34, subsection (b)(2) of 19 TAC;

(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories;

(C) know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed;

(D) distinguish between scientific hypotheses and scientific theories;

(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;

(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;

(G) analyze, evaluate, make inferences, and predict trends from data; and

(H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.

(B.3) **Scientific processes.** The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to

(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;

(C) draw inferences based on data related to promotional materials for products and services;

(D) evaluate the impact of scientific research on society and the environment;

(E) evaluate models according to their limitations in representing biological objects or events; and

(F) research and describe the history of biology and contributions of scientists.

STAAR Biology Blueprint

Scientific Process Skills is not a separate reporting category. These skills will be incorporated into at least 40% of the test questions from reporting categories 1–5 and will be identified along with the content standards.				
Reporting Categories	**Number of Standards**		**Number of Questions**	
Reporting Category 1: Cell Structure and Function	Readiness Standards	4	**11**	
	Supporting Standards	5		
	Total	9		
Reporting Category 2: Mechanisms of Genetics	Readiness Standards	3	**11**	
	Supporting Standards	5		
	Total	8		
Reporting Category 3: Biological Evolution and Classification	Readiness Standards	3	**10**	
	Supporting Standards	7		
	Total	10		
Reporting Category 4: Biological Processes and Systems	Readiness Standards	2	**11**	
	Supporting Standards	4		
	Total	6		
Reporting Category 5: Interdependence within Environmental Systems	Readiness Standards	4	**11**	
	Supporting Standards	5		
	Total	9		
Readiness Standards	**Total Number of Standards**	**16**	**60%–65%**	**32–35**
Supporting Standards	**Total Number of Standards**	**26**	**35%–40%**	**19–22**
Total Number of Questions on Test			**54 Multiple Choice**	

STAAR™ Biology Assessment – Quick Reference Chart

Reporting Category 1: Cell Structure and Function – Student Expectations (11 questions of 54 total)

Readiness Standards	Supporting Standards
B.4B	B.4A
B.4C	B.5B
B.5A	B.5C
B.9A	B.5D
	B.9D

Reporting Category 2: Mechanisms of Genetics – Student Expectations (11 questions of 54 total)

Readiness Standards	Supporting Standards
B.6A	B.6B
B.6E	B.6C
B.6F	B.6D
	B.6G
	B.6H

Reporting Category 3: Biological Evolution and Classification – Student Expectations (10 questions of 54 total)

Readiness Standards	Supporting Standards
B.7A	B.7B
B.7E	B.7C
B.8B	B.7D
	B.7F
	B.7G
	B.8A
	B.8C

Reporting Category 4: Biological Processes and Systems – Student Expectations (11 questions of 54 total)

Readiness Standards	Supporting Standards
B.10A	B.9B
B.10B	B.9C
	B.10C
	B.11A

Reporting Category 5: Interdependence within Environmental Systems – Student Expectations (11 questions of 54 total)

Readiness Standards	Supporting Standards
B.11D	B.11B
B.12A	B.11C
B.12C	B.12B
B.12F	B.12D
	B.12E

Scientific Process Skills

These skills will not be listed under a separate reporting category. Instead, they will be incorporated into at least 40% of the test questions in reporting categories 1–5 and will be identified along with content standards.

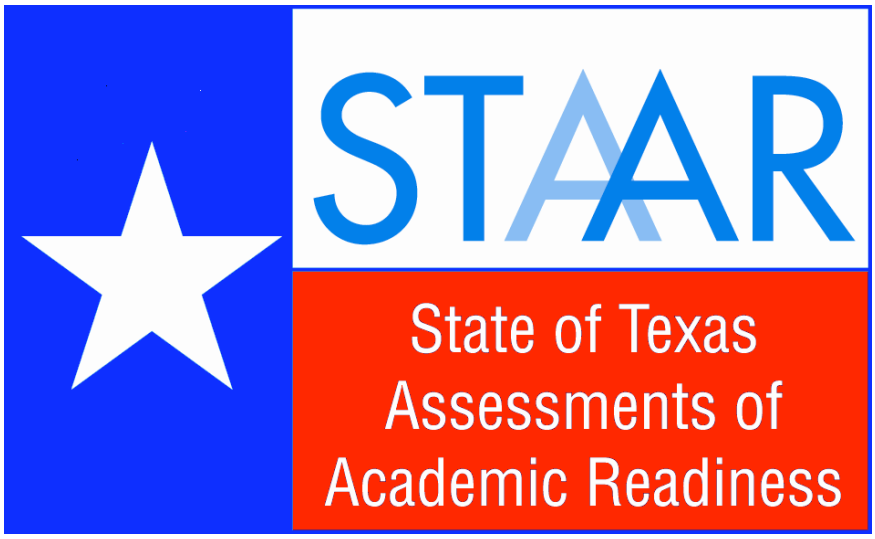
Biology Student Expectations
B.1A, B.1B
B.2A, B.2B, B.2C, B.2D, B.2E, B.2F, B.2G, B.2H
B.3A, B.3B, B.3C, B.3D, B.3E, B.3F

Total Number of Readiness Standards = 16	60%–65% of Test (between 32-35 questions on test)
Total Number of Supporting Standards = 26	35%–40% of Test (between 19-22 questions on test)

Total Number of Questions = 54 Multiple Choice

Information excerpted from http://www.tea.state.tx.us/student.assessment/staar/

STAAR Chemistry Resources



Chemistry Assessment

Eligible Texas Essential Knowledge and Skills

Texas Education Agency
Student Assessment Division
Fall 2010

STAAR Chemistry Assessment

Reporting Category 1: Matter and the Periodic Table

The student will demonstrate an understanding of the properties of matter and the periodic table.

(C.4) **Science concepts.** The student knows the characteristics of matter and can analyze the relationships between chemical and physical changes and properties. The student is expected to

(A) differentiate between physical and chemical changes and properties; ***Readiness Standard***

(B) identify extensive and intensive properties; ***Supporting Standard***

(C) compare solids, liquids, and gases in terms of compressibility, structure, shape, and volume; and ***Supporting Standard***

(D) classify matter as pure substances or mixtures through investigation of their properties. ***Readiness Standard***

(C.5) **Science concepts.** The student understands the historical development of the Periodic Table and can apply its predictive power. The student is expected to

(A) explain the use of chemical and physical properties in the historical development of the Periodic Table; ***Supporting Standard***

(B) use the Periodic Table to identify and explain the properties of chemical families, including alkali metals, alkaline earth metals, halogens, noble gases, and transition metals; and ***Readiness Standard***

(C) use the Periodic Table to identify and explain periodic trends, including atomic and ionic radii, electronegativity, and ionization energy. ***Readiness Standard***

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Reporting Category 2:
Atomic Structure and Nuclear Chemistry

The student will demonstrate an understanding of atomic theory and nuclear chemistry.

(C.6) **Science concepts.** The student knows and understands the historical development of atomic theory. The student is expected to

(A) understand the experimental design and conclusions used in the development of modern atomic theory, including Dalton's Postulates, Thomson's discovery of electron properties, Rutherford's nuclear atom, and Bohr's nuclear atom; ***Supporting Standard***

(B) understand the electromagnetic spectrum and the mathematical relationships between energy, frequency, and wavelength of light; ***Supporting Standard***

(C) calculate the wavelength, frequency, and energy of light using Planck's constant and the speed of light; ***Supporting Standard***

(D) use isotopic composition to calculate average atomic mass of an element; and ***Supporting Standard***

(E) express the arrangement of electrons in atoms through electron configurations and Lewis valence electron dot structures. ***Readiness Standard***

(C.12) **Science concepts.** The student understands the basic processes of nuclear chemistry. The student is expected to

(A) describe the characteristics of alpha, beta, and gamma radiation; ***Supporting Standard***

(B) describe radioactive decay process in terms of balanced nuclear equations; and ***Readiness Standard***

(C) compare fission and fusion reactions. ***Supporting Standard***

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Fall 2010

Reporting Category 3:
Bonding and Chemical Reactions

The student will demonstrate an understanding of how atoms form bonds and can qualify the changes that occur during chemical reactions.

(C.7) **Science concepts.** The student knows how atoms form ionic, metallic, and covalent bonds. The student is expected to

(A) name ionic compounds containing main group or transition metals, covalent compounds, acids, and bases, using International Union of Pure and Applied Chemistry (IUPAC) nomenclature rules; ***Readiness Standard***

(B) write the chemical formulas of common polyatomic ions, ionic compounds containing main group or transition metals, covalent compounds, acids, and bases; ***Readiness Standard***

(C) construct electron dot formulas to illustrate ionic and covalent bonds; ***Readiness Standard***

(D) describe the nature of metallic bonding and apply the theory to explain metallic properties such as thermal and electrical conductivity, malleability, and ductility; and ***Supporting Standard***

(E) predict molecular structure for molecules with linear, trigonal planar, or tetrahedral electron pair geometries using Valence Shell Electron Pair Repulsion (VSEPR) theory. ***Supporting Standard***

(C.8) **Science concepts.** The student can quantify the changes that occur during chemical reactions. The student is expected to

(A) define and use the concept of a mole; ***Supporting Standard***

(B) use the mole concept to calculate the number of atoms, ions, or molecules in a sample of material; ***Readiness Standard***

(C) calculate percent composition and empirical and molecular formulas; ***Supporting Standard***

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(D) use the law of conservation of mass to write and balance chemical equations; and ***Readiness Standard***

(E) perform stoichiometric calculations, including determination of mass relationships between reactants and products, calculation of limiting reagents, and percent yield. ***Supporting Standard***

Reporting Category 4:
Gases and Thermochemistry

The student will demonstrate an understanding of the conditions that influence the behavior of gases and the energy changes that occur in chemical reactions.

(C.9) **Science concepts.** The student understands the principles of ideal gas behavior, kinetic molecular theory, and the conditions that influence the behavior of gases. The student is expected to

(A) describe and calculate the relations between volume, pressure, number of moles, and temperature for an ideal gas as described by Boyle's law, Charles' law, Avogadro's law, Dalton's law of partial pressure, and the ideal gas law; ***Readiness Standard***

(B) perform stoichiometric calculations, including determination of mass and volume relationships between reactants and products for reactions involving gases; and ***Supporting Standard***

(C) describe the postulates of kinetic molecular theory. ***Supporting Standard***

(C.11) **Science concepts.** The student understands the energy changes that occur in chemical reactions. The student is expected to

(A) understand energy and its forms, including kinetic, potential, chemical, and thermal energies; ***Supporting Standard***

(B) understand the law of conservation of energy and the processes of heat transfer; ***Supporting Standard***

(C) use thermochemical equations to calculate energy changes that occur in chemical reactions and classify reactions as exothermic or endothermic; ***Readiness Standard***

(D) perform calculations involving heat, mass, temperature change, and specific heat; and ***Supporting Standard***

(E) use calorimetry to calculate the heat of a chemical process. ***Supporting Standard***

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Reporting Category 5:
Solutions

The student will demonstrate an understanding of solutions and can apply the factors that influence the behavior of solutions.

(C.10) **Science concepts.** The student understands and can apply the factors that influence the behavior of solutions. The student is expected to

(A) describe the unique role of water in chemical and biological systems; ***Supporting Standard***

(B) develop and use general rules regarding solubility through investigations with aqueous solutions; ***Readiness Standard***

(C) calculate the concentration of solutions in units of molarity; ***Supporting Standard***

(D) use molarity to calculate the dilutions of solutions; ***Supporting Standard***

(E) distinguish between types of solutions such as electrolytes and nonelectrolytes and unsaturated, saturated, and supersaturated solutions; ***Readiness Standard***

(F) investigate factors that influence solubilities and rates of dissolution such as temperature, agitation, and surface area; ***Readiness Standard***

(G) define acids and bases and distinguish between Arrhenius and Bronsted-Lowry definitions and predict products in acid-base reactions that form water; ***Supporting Standard***

(H) understand and differentiate among acid-base reactions, precipitation reactions, and oxidation-reduction reactions; ***Readiness Standard***

(I) define pH and use the hydrogen or hydroxide ion concentrations to calculate the pH of a solution; and ***Supporting Standard***

(J) distinguish between degrees of dissociation for strong and weak acids and bases. ***Supporting Standard***

Texas Education Agency
Student Assessment Division
Fall 2010

Scientific Process Skills

These skills will not be listed under a separate reporting category. Instead, they will be incorporated into at least 40% of the test questions from reporting categories 1–5 and will be identified along with content standards.

(C.1) **Scientific processes.** The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to

(A) demonstrate safe practices during laboratory and field investigations, including the appropriate use of safety showers, eyewash fountains, safety goggles, and fire extinguishers;

(B) know specific hazards of chemical substances such as flammability, corrosiveness, and radioactivity as summarized on the Material Safety Data Sheets (MSDS); and

(C) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.

(C.2) **Scientific processes.** The student uses scientific methods to solve investigative questions. The student is expected to

(A) know the definition of science and understand that it has limitations, as specified in chapter 112.35, subsection (b)(2) of 19 TAC;

(B) know that scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories;

(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but may be subject to change as new areas of science and new technologies are developed;

(D) distinguish between scientific hypotheses and scientific theories;

(E) plan and implement investigative procedures, including asking questions, formulating testable hypotheses, and selecting equipment and technology, including graphing calculators, computers and probes, sufficient scientific glassware such as beakers, Erlenmeyer flasks, pipettes, graduated cylinders, volumetric flasks, safety goggles, and burettes, electronic balances, and an adequate supply of consumable chemicals;

(F) collect data and make measurements with accuracy and precision;

(G) express and manipulate chemical quantities using scientific conventions and mathematical procedures, including dimensional analysis, scientific notation, and significant figures;

(H) organize, analyze, evaluate, make inferences, and predict trends from data; and

(I) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphs, journals, summaries, oral reports, and technology-based reports.

(C.3) **Scientific processes.** The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to

(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;

(C) draw inferences based on data related to promotional materials for products and services;

(D) evaluate the impact of research on scientific thought, society, and the environment;

(E) describe the connection between chemistry and future careers; and

(F) research and describe the history of chemistry and contributions of scientists.

STAAR Chemistry Blueprint

Scientific Process Skills is not a separate reporting category. These skills will be incorporated into at least 40% of the test questions from reporting categories 1–5 and will be identified along with the content standards.				
Reporting Categories	**Number of Standards**		**Number of Questions**	
Reporting Category 1: Matter and the Periodic Table	Readiness Standards	4	**12**	
	Supporting Standards	3		
	Total	7		
Reporting Category 2: Atomic Structure and Nuclear Chemistry	Readiness Standards	2	**9**	
	Supporting Standards	6		
	Total	8		
Reporting Category 3: Bonding and Chemical Reactions	Readiness Standards	5	**14**	
	Supporting Standards	5		
	Total	10		
Reporting Category 4: Gases and Thermochemistry	Readiness Standards	2	**8**	
	Supporting Standards	6		
	Total	8		
Reporting Category 5: Solutions	Readiness Standards	4	**9**	
	Supporting Standards	6		
	Total	10		
Readiness Standards	**Total Number of Standards**	**17**	**60%–65%**	**31–34**
Supporting Standards	**Total Number of Standards**	**26**	**35%–40%**	**18–21**
Total Number of Questions on Test			**47 Multiple Choice 5 Griddable 52 Total**	

STAAR™ Chemistry Assessment – Quick Reference Chart

Reporting Category 1: Matter and the Periodic Table – Student Expectations (12 questions of 52 total)

Readiness Standards	Supporting Standards
C.4A	C.4B
C.4D	C.4C
C.5B	C.5A
C.5C	

Reporting Category 2: Atomic Structure and Nuclear Chemistry – Student Expectations (9 questions of 52 total)

Readiness Standards	Supporting Standards
C.6E	C.6A
C.12B	C.6B
	C.6C
	C.6D
	C.12A
	C.12C

Reporting Category 3: Bonding and Chemical Reactions – Student Expectations (14 questions of 52 total)

Readiness Standards	Supporting Standards
C.7A	C.7D
C.7B	C.7E
C.7C	C.8A
C.8B	C.8C
C.8D	C.8E

Reporting Category 4: Gases and Thermochemistry – Student Expectations (8 questions of 52 total)

Readiness Standards	Supporting Standards
C.9A	C.9B
C.11C	C.9C
	C.11A
	C.11B
	C.11D
	C.11E

Reporting Category 5: Solutions – Student Expectations (9 questions of 52 total)

Readiness Standards	Supporting Standards
C.10B	C.10A
C.10E	C.10C
C.10F	C.10D
C.10H	C.10G
	C.10I
	C.10J

Scientific Process Skills

These skills will not be listed under a separate reporting category. Instead, they will be incorporated into at least 40% of the test questions in reporting categories 1–5 and will be identified along with content standards.

Chemistry Student Expectations
C.1A, C.1B, C.1C
C.2A, C.2B, C.2C, C.2D, C.2E, C.2F, C.2G, C.2H, C.2I
C.3A, C.3B, C.3C, C.3D, C.3E, C.3F

Total Number of Readiness Standards = 17	60%–65% of Test (between 31-34 questions on test)
Total Number of Supporting Standards = 26	35%–40% of Test (between 18-21 questions on test)
Total Number of Questions = 52 (47 Multiple Choice and 5 Griddable)	

Information excerpted from http://www.tea.state.tx.us/student.assessment/staar/

STAAR CHEMISTRY REFERENCE MATERIALS

ATOMIC STRUCTURE

Speed of light = (frequency)(wavelength) $c = f\lambda$

Energy = (Planck's constant)(frequency) $E_{photon} = hf$

$$\text{Energy} = \frac{(\text{Planck's constant})(\text{speed of light})}{(\text{wavelength})} \qquad E_{photon} = \frac{hc}{\lambda}$$

BEHAVIOR OF GASES

$$\text{Total pressure of a gas} = \begin{pmatrix}\text{sum of the partial pressures}\\ \text{of the component gases}\end{pmatrix} \qquad P_T = P_1 + P_2 + P_3 + \ \ldots$$

(Pressure)(volume) = (moles)(ideal gas constant)(temperature) $PV = nRT$

$$\frac{(\text{Initial pressure})(\text{initial volume})}{(\text{Initial moles})(\text{initial temperature})} = \frac{(\text{final pressure})(\text{final volume})}{(\text{final moles})(\text{final temperature})} \qquad \frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$$

(Initial pressure)(initial volume) = (final pressure)(final volume) $P_1V_1 = P_2V_2$

$$\frac{(\text{Initial volume})}{(\text{Initial temperature})} = \frac{(\text{final volume})}{(\text{final temperature})} \qquad \frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{(\text{Initial volume})}{(\text{Initial moles})} = \frac{(\text{final volume})}{(\text{final moles})} \qquad \frac{V_1}{n_1} = \frac{V_2}{n_2}$$

SOLUTIONS

$$\text{Molarity} = \frac{\text{moles of solute}}{\text{liter of solution}} \qquad M = \frac{\text{mol}}{\text{L}}$$

$$\text{Ionization constant of water} = \begin{pmatrix}\text{hydrogen ion}\\ \text{concentration}\end{pmatrix}\begin{pmatrix}\text{hydroxide ion}\\ \text{concentration}\end{pmatrix} \qquad K_w = [H^+][OH^-]$$

$$\begin{pmatrix}\text{Volume of}\\ \text{solution 1}\end{pmatrix}\begin{pmatrix}\text{molarity of}\\ \text{solution 1}\end{pmatrix} = \begin{pmatrix}\text{volume of}\\ \text{solution 2}\end{pmatrix}\begin{pmatrix}\text{molarity of}\\ \text{solution 2}\end{pmatrix} \qquad V_1M_1 = V_2M_2$$

pH = –logarithm (hydrogen ion concentration) $pH = -\log[H^+]$

THERMOCHEMISTRY

$$\text{Heat gained or lost} = (\text{mass})\begin{pmatrix}\text{specific}\\ \text{heat}\end{pmatrix}\begin{pmatrix}\text{change in}\\ \text{temperature}\end{pmatrix} \qquad Q = mc_p\Delta T$$

$$\text{Enthalpy of reaction} = \begin{pmatrix}\text{enthalpy}\\ \text{of products}\end{pmatrix} - \begin{pmatrix}\text{enthalpy}\\ \text{of reactants}\end{pmatrix} \qquad \Delta H = \Delta H^o_f(\text{products}) - \Delta H^o_f(\text{reactants})$$

STAAR CHEMISTRY REFERENCE MATERIALS

OTHER FORMULAS

$$\text{Density} = \frac{\text{mass}}{\text{volume}} \qquad D = \frac{m}{V}$$

$$\text{Percent error} = \left(\frac{\text{accepted value} - \text{experimental value}}{\text{accepted value}}\right)(100)$$

$$\text{Percent yield} = \left(\frac{\text{actual yield}}{\text{theoretical yield}}\right)(100)$$

CONSTANTS AND CONVERSIONS

Avogadro's number $= 6.02 \times 10^{23}$ particles per mole

h = Planck's constant $= 6.63 \times 10^{-34}\ \text{J} \cdot \text{s}$

c = speed of light $= 3.00 \times 10^{8}\ \frac{\text{m}}{\text{s}}$

K_w = ionization constant of water $= 1.00 \times 10^{-14}\left(\frac{\text{mol}}{\text{L}}\right)^2$

alpha particle (α) $= {}^{4}_{2}\text{He}$ beta particle (β) $= {}^{0}_{-1}\text{e}$ neutron $= {}^{1}_{0}\text{n}$

standard temperature and pressure (STP) = 0°C and 1 atm

0°C = 273 K

volume of ideal gas at STP $= 22.4\ \frac{\text{L}}{\text{mol}}$

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

1 atm = 760 mm Hg = 101.3 kPa

R = ideal gas constant $= 0.0821\ \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} = 8.31\ \frac{\text{L} \cdot \text{kPa}}{\text{mol} \cdot \text{K}} = 62.4\ \frac{\text{L} \cdot \text{mm Hg}}{\text{mol} \cdot \text{K}}$

1 calorie (cal) = 4.18 joules (J)

1000 calories (cal) = 1 Calorie (Cal) = 1 kilocalorie (kcal)

RULES FOR SIGNIFICANT FIGURES

1. Non-zero digits and zeros between non-zero digits are always significant.
2. Leading zeros are not significant.
3. Zeros to the right of all non-zero digits are only significant if a decimal point is shown.
4. For values written in scientific notation, the digits in the coefficient are significant.
5. In a common logarithm, there are as many digits after the decimal point as there are significant figures in the original number.

STAAR CHEMISTRY REFERENCE MATERIALS

STAAR State of Texas Assessments of Academic Readiness

POLYATOMIC IONS

Acetate	$C_2H_3O_2^-$, CH_3COO^-
Ammonium	NH_4^+
Carbonate	CO_3^{2-}
Chlorate	ClO_3^-
Chlorite	ClO_2^-
Chromate	CrO_4^{2-}
Cyanide	CN^-
Dichromate	$Cr_2O_7^{2-}$
Hydrogen carbonate	HCO_3^-
Hydroxide	OH^-
Hypochlorite	ClO^-
Nitrate	NO_3^-
Nitrite	NO_2^-
Perchlorate	ClO_4^-
Permanganate	MnO_4^-
Phosphate	PO_4^{3-}
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

SOLUBILITY OF COMMON IONIC COMPOUNDS IN WATER

Soluble compounds contain	**Common exceptions**
$C_2H_3O_2^-$, CH_3COO^-	None
NH_4^+	None
NO_3^-	None
CN^-	None
ClO^-	None
ClO_2^-	None
ClO_3^-	None
ClO_4^-	None
Br^-	Compounds of Ag^+, Pb^{2+}, and Hg_2^{2+}
Cl^-	Compounds of Ag^+, Pb^{2+}, and Hg_2^{2+}
I^-	Compounds of Sr^{2+}, Ba^{2+}, Pb^{2+}, and Hg_2^{2+}
SO_4^{2-}	Compounds of Sr^{2+}, Ba^{2+}, Pb^{2+}, and Hg_2^{2+}

Insoluble compounds contain	**Common exceptions**
CO_3^{2-}	Compounds of NH_4^+ and the alkali metal cations
PO_4^{3-}	Compounds of NH_4^+ and the alkali metal cations
CrO_4^{2-}	Compounds of NH_4^+ and the alkali metal cations
$Cr_2O_7^{2-}$	Compounds of NH_4^+ and the alkali metal cations
OH^-	Compounds of NH_4^+, the alkali metal cations, Ca^{2+}, Sr^{2+}, and Ba^{2+}
S^{2-}	Compounds of NH_4^+, the alkali metal cations, Ca^{2+}, Sr^{2+}, and Ba^{2+}

ACTIVITY SERIES

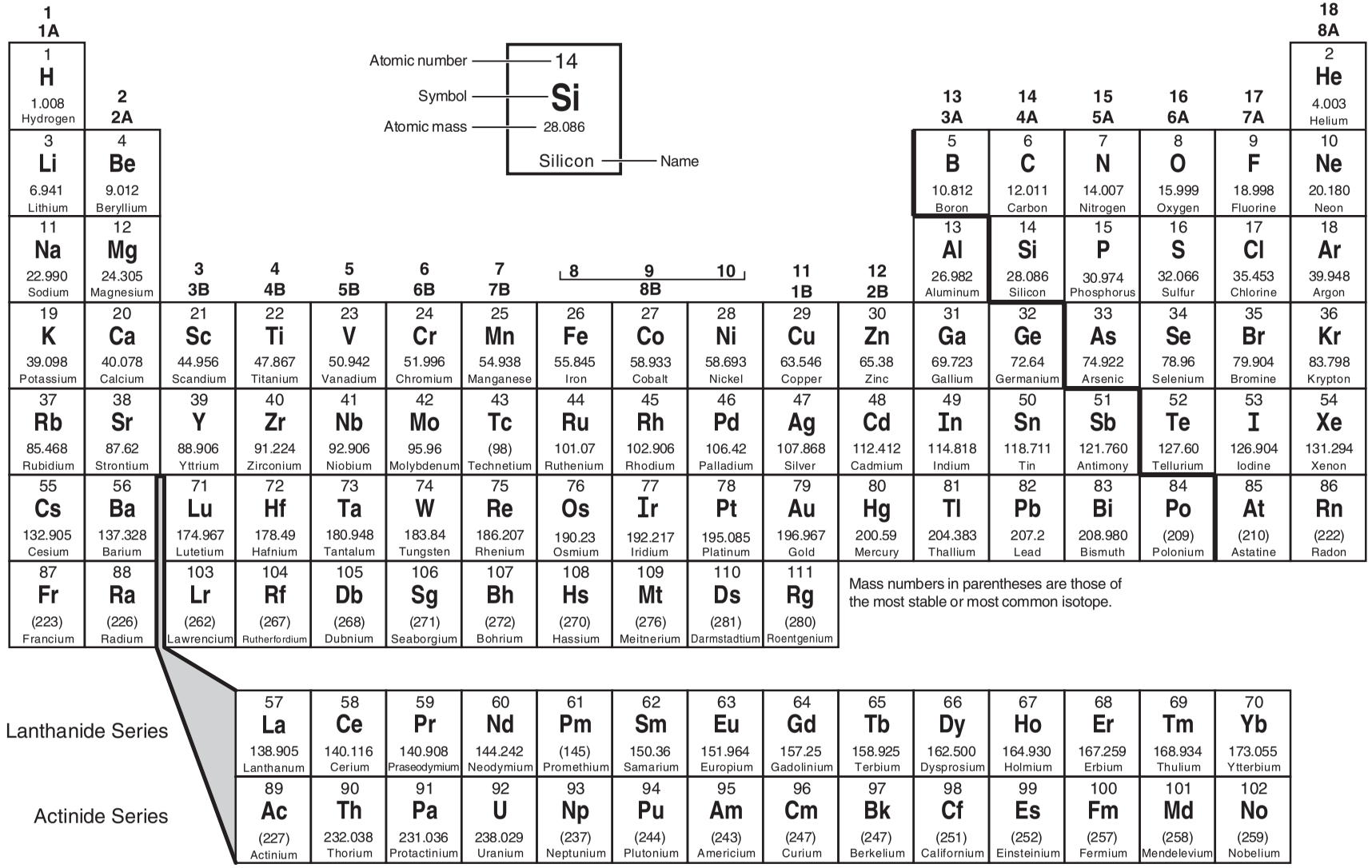
Metal

Lithium
Potassium
Barium
Calcium
Sodium
Magnesium
Aluminum
Manganese
Zinc
Chromium
Iron
Cobalt
Nickel
Tin
Lead
(Hydrogen)
Copper
Mercury
Silver
Platinum
Gold

STAAR CHEMISTRY REFERENCE MATERIALS

STAAR™ State of Texas Assessments of Academic Readiness

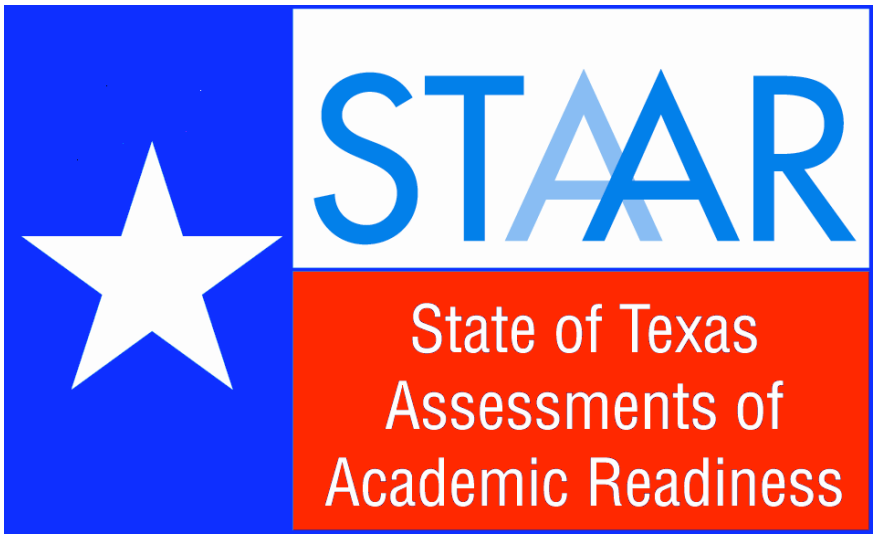
PERIODIC TABLE OF THE ELEMENTS



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

Updated Spring 2011

STAAR Physics Resources



Physics Assessment

Eligible Texas Essential Knowledge and Skills

Texas Education Agency
Student Assessment Division
Fall 2010

STAAR Physics Assessment

Reporting Category 1: Force and Motion

The student will demonstrate an understanding of the relationship of force and motion in one and two dimensions.

(P.4) **Science concepts.** The student knows and applies the laws governing motion in a variety of situations. The student is expected to

(A) generate and interpret graphs and charts describing different types of motion, including the use of real-time technology such as motion detectors or photogates; ***Readiness Standard***

(B) describe and analyze motion in one dimension using equations with the concepts of distance, displacement, speed, average velocity, instantaneous velocity, and acceleration; ***Readiness Standard***

(C) analyze and describe accelerated motion in two dimensions using equations, including projectile and circular examples; ***Supporting Standard***

(D) calculate the effect of forces on objects, including the law of inertia, the relationship between force and acceleration, and the nature of force pairs between objects; ***Readiness Standard***

(E) develop and interpret free-body force diagrams; and ***Supporting Standard***

(F) identify and describe motion relative to different frames of reference. ***Supporting Standard***

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Reporting Category 2:
Gravitational, Electrical, Magnetic, and Nuclear Forces

The student will demonstrate an understanding of gravitational, electrical, magnetic, and nuclear forces.

(P.5) **Science concepts.** The student knows the nature of forces in the physical world. The student is expected to

(A) research and describe the historical development of the concepts of gravitational, electromagnetic, weak nuclear, and strong nuclear forces; ***Supporting Standard***

(B) describe and calculate how the magnitude of the gravitational force between two objects depends on their masses and the distance between their centers; ***Readiness Standard***

(C) describe and calculate how the magnitude of the electrical force between two objects depends on their charges and the distance between them; ***Supporting Standard***

(D) identify examples of electric and magnetic forces in everyday life; ***Supporting Standard***

(E) characterize materials as conductors or insulators based on their electrical properties; ***Supporting Standard***

(F) design, construct, and calculate in terms of current through, potential difference across, resistance of, and power used by electric circuit elements connected in both series and parallel combinations; ***Readiness Standard***

(G) investigate and describe the relationship between electric and magnetic fields in applications such as generators, motors, and transformers; and ***Supporting Standard***

(H) describe evidence for and effects of the strong and weak nuclear forces in nature. ***Supporting Standard***

Texas Education Agency
Student Assessment Division
Fall 2010

Reporting Category 3:
Momentum and Energy

The student will demonstrate an understanding of momentum and energy.

(P.6) **Science concepts.** The student knows that changes occur within a physical system and applies the laws of conservation of energy and momentum. The student is expected to

(A) investigate and calculate quantities using the work-energy theorem in various situations; ***Readiness Standard***

(B) investigate examples of kinetic and potential energy and their transformations; ***Readiness Standard***

(C) calculate the mechanical energy of, power generated within, impulse applied to, and momentum of a physical system; ***Readiness Standard***

(D) demonstrate and apply the laws of conservation of energy and conservation of momentum in one dimension; ***Readiness Standard***

(E) describe how the macroscopic properties of a thermodynamic system such as temperature, specific heat, and pressure are related to the molecular level of matter, including kinetic or potential energy of atoms; ***Supporting Standard***

(F) contrast and give examples of different processes of thermal energy transfer, including conduction, convection, and radiation; and ***Supporting Standard***

(G) analyze and explain everyday examples that illustrate the laws of thermodynamics, including the law of conservation of energy and the law of entropy. ***Supporting Standard***

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Reporting Category 4:
Waves and Quantum Phenomena

The student will demonstrate an understanding of waves and quantum phenomena.

(P.7) **Science concepts.** The student knows the characteristics and behavior of waves. The student is expected to

(A) examine and describe oscillatory motion and wave propagation in various types of media; ***Supporting Standard***

(B) investigate and analyze characteristics of waves, including velocity, frequency, amplitude, and wavelength, and calculate using the relationship between wavespeed, frequency, and wavelength; ***Readiness Standard***

(C) compare characteristics and behaviors of transverse waves, including electromagnetic waves and the electromagnetic spectrum, and characteristics and behaviors of longitudinal waves, including sound waves; ***Supporting Standard***

(D) investigate behaviors of waves, including reflection, refraction, diffraction, interference, resonance, and the Doppler effect; ***Readiness Standard***

(E) describe and predict image formation as a consequence of reflection from a plane mirror and refraction through a thin convex lens; and ***Supporting Standard***

(F) describe the role of wave characteristics and behaviors in medical and industrial applications. ***Supporting Standard***

(P.8) **Science concepts.** The student knows simple examples of atomic, nuclear, and quantum phenomena. The student is expected to

(A) describe the photoelectric effect and the dual nature of light; ***Readiness Standard***

(B) compare and explain the emission spectra produced by various atoms; ***Supporting Standard***

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(C) describe the significance of mass-energy equivalence and apply it in explanations of phenomena such as nuclear stability, fission, and fusion; and ***Supporting Standard***

(D) give examples of applications of atomic and nuclear phenomena such as radiation therapy, diagnostic imaging, and nuclear power and examples of applications of quantum phenomena such as digital cameras. ***Supporting Standard***

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Scientific Process Skills

These skills will not be listed under a separate reporting category. Instead, they will be incorporated into at least 40% of the test questions from reporting categories 1–4 and will be identified along with content standards.

(P.1) **Scientific processes.** The student conducts investigations, for at least 40% of instructional time, using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to

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

(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.

(P.2) **Scientific processes.** The student uses a systematic approach to answer scientific laboratory and field investigative questions. The student is expected to

(A) know the definition of science and understand that it has limitations, as specified in chapter 112.39, subsection (b)(2) of 19 TAC;

(B) know that scientific hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power which have been tested over a wide variety of conditions are incorporated into theories;

(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but may be subject to change as new areas of science and new technologies are developed;

(D) distinguish between scientific hypotheses and scientific theories;

(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness;

(F) demonstrate the use of course apparatus, equipment, techniques, and procedures, including multimeters (current, voltage, resistance), triple beam balances, batteries, clamps, dynamics demonstration equipment, collision apparatus, data acquisition probes, discharge tubes with power supply (H, He, Ne, Ar), hand-held visual spectroscopes, hot plates, slotted and hooked lab masses, bar magnets, horseshoe magnets, plane mirrors, convex lenses, pendulum support, power supply, ring clamps, ring stands, stopwatches, trajectory apparatus, tuning forks, carbon paper, graph paper, magnetic compasses, polarized film, prisms, protractors, resistors, friction blocks, mini lamps (bulbs) and sockets, electrostatics kits, 90-degree rod clamps, metric rulers, spring scales, knife blade switches, Celsius thermometers, meter sticks, scientific calculators, graphing technology, computers, cathode ray tubes with horseshoe magnets, ballistic carts or equivalent, resonance tubes, spools of nylon thread or string, containers of iron filings, rolls of white craft paper, copper wire, Periodic Table, electromagnetic spectrum charts, slinky springs, wave motion ropes, and laser pointers;

(G) use a wide variety of additional course apparatus, equipment, techniques, materials, and procedures as appropriate such as ripple tank with wave generator, wave motion rope, micrometer, caliper, radiation monitor, computer, ballistic pendulum, electroscope, inclined plane, optics bench, optics kit, pulley with table clamp, resonance tube, ring stand screen, four-inch ring, stroboscope, graduated cylinders, and ticker timer;

(H) make measurements with accuracy and precision and record data using scientific notation and International System (SI) units;

(I) identify and quantify causes and effects of uncertainties in measured data;

(J) organize and evaluate data and make inferences from data, including the use of tables, charts, and graphs;

(K) communicate valid conclusions supported by the data through various methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports; and

(L) express and manipulate relationships among physical variables quantitatively, including the use of graphs, charts, and equations.

(P.3) **Scientific processes.** The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to

(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;

(C) draw inferences based on data related to promotional materials for products and services;

(D) explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society;

(E) research and describe the connections between physics and future careers; and

(F) express and interpret relationships symbolically in accordance with accepted theories to make predictions and solve problems mathematically, including problems requiring proportional reasoning and graphical vector addition.

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STAAR Physics Blueprint

Scientific Process Skills is not a separate reporting category. These skills will be incorporated into at least 40% of the test questions from reporting categories 1–4 and will be identified along with the content standards.				
Reporting Categories	**Number of Standards**		**Number of Questions**	
Reporting Category 1: Force and Motion	Readiness Standards	3	**14**	
	Supporting Standards	3		
	Total	6		
Reporting Category 2: Gravitational, Electrical, Magnetic, and Nuclear Forces	Readiness Standards	2	**12**	
	Supporting Standards	6		
	Total	8		
Reporting Category 3: Momentum and Energy	Readiness Standards	4	**12**	
	Supporting Standards	3		
	Total	7		
Reporting Category 4: Waves and Quantum Phenomena	Readiness Standards	3	**12**	
	Supporting Standards	7		
	Total	10		
Readiness Standards	**Total Number of Standards**	**12**	**60%–65%**	**30–33**
Supporting Standards	**Total Number of Standards**	**19**	**35%–40%**	**17–20**
Total Number of Questions on Test			**45 Multiple Choice 5 Griddable 50 Total**	

STAAR™ Physics Assessment – Quick Reference Chart

Reporting Category 1: Force and Motion – Student Expectations (14 questions of 50 total)

Readiness Standards	Supporting Standards
P.4A	P.4C
P.4B	P.4E
P.4D	P.4F

Reporting Category 2: Gravitational, Electrical, Magnetic, and Nuclear Forces – Student Expectations (12 questions of 50 total)

Readiness Standards	Supporting Standards
P.5B	P.5A
P.5F	P.5C
	P.5D
	P.5E
	P.5G
	P.5H

Reporting Category 3: Momentum and Energy – Student Expectations (12 questions of 50 total)

Readiness Standards	Supporting Standards
P.6A	P.6E
P.6B	P.6F
P.6C	P.6G
P.6D	

Reporting Category 4: Waves and Quantum Phenomena – Student Expectations (12 questions of 50 total)

Readiness Standards	Supporting Standards
P.7B	P.7A
P.7D	P.7C
P.8A	P.7E
	P.7F
	P.8B
	P.8C
	P.8D

Scientific Process Skills

These skills will not be listed under a separate reporting category. Instead, they will be incorporated into at least 40% of the test questions in reporting categories 1–4 and will be identified along with content standards.

Physics Student Expectations
P.1A, P.1B
P.2A, P.2B, P.2C, P.2D, P.2E, P.2F, P.2G, P.2H, P.2I, P.2J, P.2K, P.2L
P.3A, P.3B, P.3C, P.3D, P.3E, P.3F

Total Number of Readiness Standards = 12	60%–65% of Test (between 30-33 questions on test)
Total Number of Supporting Standards = 19	35%–40% of Test (between 17-20 questions on test)

Total Number of Questions = 50 (45 Multiple Choice and 5 Griddable)

Information excerpted from http://www.tea.state.tx.us/student.assessment/staar/

STAAR PHYSICS REFERENCE MATERIALS

FORCE AND MOTION

Average velocity $= \frac{\text{displacement}}{\text{change in time}}$	$v_{avg} = \frac{\Delta d}{\Delta t}$
Acceleration $= \frac{\text{final velocity} - \text{initial velocity}}{\text{change in time}}$	$a = \frac{v_f - v_i}{\Delta t}$
Acceleration $= \frac{(\text{final velocity})^2 - (\text{initial velocity})^2}{2(\text{displacement})}$	$a = \frac{v_f^2 - v_i^2}{2\Delta d}$
Displacement $= \begin{pmatrix}\text{initial}\\ \text{velocity}\end{pmatrix}\begin{pmatrix}\text{change}\\ \text{in time}\end{pmatrix} + \frac{1}{2}(\text{acceleration})\begin{pmatrix}\text{change}\\ \text{in time}\end{pmatrix}^2$	$\Delta d = v_i \Delta t + \frac{1}{2} a \Delta t^2$
Centripetal acceleration $= \frac{(\text{tangential velocity})^2}{\text{radius}}$	$a_c = \frac{v_t^2}{r}$
Net force = (mass)(acceleration)	$F_{net} = ma$
Work = (force)(distance)	$W = Fd$
Torque = (force)(lever arm)	$\tau = Fr$
Power $= \frac{\text{work}}{\text{time}}$	$P = \frac{W}{t}$
Pythagorean theorem	$a^2 + b^2 = c^2$

GRAVITATIONAL, ELECTRICAL, AND MAGNETIC FORCES

Force of gravitational attraction between 2 objects $= \begin{pmatrix}\text{universal}\\ \text{gravitation}\\ \text{constant}\end{pmatrix}\left(\frac{\begin{pmatrix}\text{mass of}\\ \text{1st object}\end{pmatrix}\begin{pmatrix}\text{mass of}\\ \text{2nd object}\end{pmatrix}}{\begin{pmatrix}\text{distance between}\\ \text{centers of objects}\end{pmatrix}^2}\right)$	$F_g = G\left(\frac{m_1 m_2}{d^2}\right)$
Force between 2 charged particles $= \begin{pmatrix}\text{Coulomb's}\\ \text{constant}\end{pmatrix}\left(\frac{\begin{pmatrix}\text{charge of}\\ \text{1st particle}\end{pmatrix}\begin{pmatrix}\text{charge of}\\ \text{2nd particle}\end{pmatrix}}{(\text{distance between particles})^2}\right)$	$F_{electric} = k_C\left(\frac{q_1 q_2}{d^2}\right)$
Electrical power = (voltage)(current)	$P = VI$
Current $= \frac{\text{voltage}}{\text{resistance}}$	$I = \frac{V}{R}$
Equivalent resistance for resistors in series	$R = R_1 + R_2 + R_3 + \ldots$
Equivalent resistance for resistors in parallel	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$

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ENERGY AND MOMENTUM

Kinetic energy $= \frac{1}{2}$(mass)(velocity)^2	$KE = \frac{1}{2}mv^2$
Gravitational potential energy $=$ (mass)$\left(\begin{matrix}\text{acceleration}\\ \text{due to gravity}\end{matrix}\right)$(height)	$PE_g = mgh$
Elastic potential energy $= \frac{1}{2}\left(\begin{matrix}\text{spring}\\ \text{constant}\end{matrix}\right)\left(\begin{matrix}\text{distance stretched}\\ \text{or compressed}\end{matrix}\right)^2$	$PE_{\text{elastic}} = \frac{1}{2}kx^2$
Energy $=$ (power)(time)	$E = Pt$
Work $=$ change in kinetic energy	$W = \Delta KE$
Mechanical energy $=$ kinetic energy + potential energy	$ME = KE + PE$
Law of conservation of energy	$KE_i + PE_i = KE_f + PE_f$
Momentum $=$ (mass)(velocity)	$p = mv$
Impulse $=$ (force)(change in time) $=$ (mass)(change in velocity)	$J = F\Delta t = m\Delta v$
Law of conservation of momentum	$m_1v_{1_i} + m_2v_{2_i} = m_1v_{1_f} + m_2v_{2_f}$
Heat gained or lost $=$ (mass)$\left(\begin{matrix}\text{specific}\\ \text{heat}\end{matrix}\right)\left(\begin{matrix}\text{change in}\\ \text{temperature}\end{matrix}\right)$	$Q = mc_p\Delta T$

WAVES AND LIGHT

Velocity $=$ (frequency)(wavelength)	$v = f\lambda$
$\frac{1}{\text{Focal length}} = \frac{1}{\text{distance to image}} + \frac{1}{\text{distance to object}}$	$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$
Energy $=$ (mass)(speed of light)^2	$E = mc^2$

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CONSTANTS AND CONVERSIONS

c = speed of light = $3.00 \times 10^{8} \frac{\text{m}}{\text{s}}$

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

G = universal gravitation constant = $6.67 \times 10^{-11} \frac{\text{N} \cdot \text{m}^2}{\text{kg}^2}$

k_C = Coulomb's constant = $8.99 \times 10^{9} \frac{\text{N} \cdot \text{m}^2}{\text{C}^2}$

m_E = mass of Earth = 5.97×10^{24} kg

r_E = radius of Earth = 6.37×10^{6} m

newton (N) = $\frac{\text{kg} \cdot \text{m}}{\text{s}^2}$

joule (J) = $\text{N} \cdot \text{m}$

watt (W) = $\frac{\text{J}}{\text{s}} = \frac{\text{N} \cdot \text{m}}{\text{s}}$

hertz (Hz) = $\frac{\text{cycle}}{\text{s}}$

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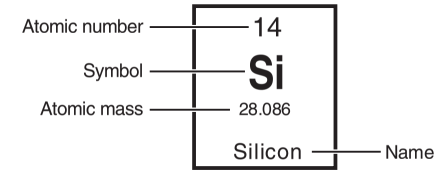
STAAR™ State of Texas Assessments of Academic Readiness



	1 1A												13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1	1 H 1.008 Hydrogen	2 2A																2 He 4.003 Helium
2	3 Li 6.941 Lithium	4 Be 9.012 Beryllium											5 B 10.812 Boron	6 C 12.011 Carbon	7 N 14.007 Nitrogen	8 O 15.999 Oxygen	9 F 18.998 Fluorine	10 Ne 20.180 Neon
3	11 Na 22.990 Sodium	12 Mg 24.305 Magnesium	3 3B	4 4B	5 5B	6 6B	7 7B	8	9 8B	10	11 1B	12 2B	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
4	19 K 39.098 Potassium	20 Ca 40.078 Calcium	21 Sc 44.956 Scandium	22 Ti 47.867 Titanium	23 V 50.942 Vanadium	24 Cr 51.996 Chromium	25 Mn 54.938 Manganese	26 Fe 55.845 Iron	27 Co 58.933 Cobalt	28 Ni 58.693 Nickel	29 Cu 63.546 Copper	30 Zn 65.38 Zinc	31 Ga 69.723 Gallium	32 Ge 72.64 Germanium	33 As 74.922 Arsenic	34 Se 78.96 Selenium	35 Br 79.904 Bromine	36 Kr 83.798 Krypton
5	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 95.96 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 112.412 Cadmium	49 In 114.818 Indium	50 Sn 118.711 Tin	51 Sb 121.760 Antimony	52 Te 127.60 Tellurium	53 I 126.904 Iodine	54 Xe 131.294 Xenon
6	55 Cs 132.905 Cesium	56 Ba 137.328 Barium	71 Lu 174.967 Lutetium	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 192.217 Iridium	78 Pt 195.085 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
7	87 Fr (223) Francium	88 Ra (226) Radium	103 Lr (262) Lawrencium	104 Rf (267) Rutherfordium	105 Db (268) Dubnium	106 Sg (271) Seaborgium	107 Bh (272) Bohrium	108 Hs (270) Hassium	109 Mt (276) Meitnerium	110 Ds (281) Darmstadtium	111 Rg (280) Roentgenium							

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

Lanthanide Series	57 La 138.905 Lanthanum	58 Ce 140.116 Cerium	59 Pr 140.908 Praseodymium	60 Nd 144.242 Neodymium	61 Pm (145) Promethium	62 Sm 150.36 Samarium	63 Eu 151.964 Europium	64 Gd 157.25 Gadolinium	65 Tb 158.925 Terbium	66 Dy 162.500 Dysprosium	67 Ho 164.930 Holmium	68 Er 167.259 Erbium	69 Tm 168.934 Thulium	70 Yb 173.055 Ytterbium
Actinide Series	89 Ac (227) Actinium	90 Th 232.038 Thorium	91 Pa 231.036 Protactinium	92 U 238.029 Uranium	93 Np (237) 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

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