STATE BOARD FOR EDUCATOR CERTIFICATION/TEXAS EDUCATION AGENCY
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TExES | Texas Examinations of Educator Standards

Preparation Manual

172 Agricultural Science and Technology 6–12

PREFACE

The State Board for Educator Certification (SBEC) has developed new standards for Texas educators that delineate what the beginning educator should know and be able to do. These standards, which are based on the state-required curriculum for students—the Texas Essential Knowledge and Skills (TEKS)—form the basis for new Texas Examinations of Educator Standards (TExES™). This initiative will affect all areas of Texas education—from the more than 100 approved Texas educator preparation programs to the more than 7,000 Texas school campuses. This standards-based system reflects the SBEC's commitment to help align Texas education from kindergarten through college. The SBEC's role in this K–16 initiative will ensure that newly certified Texas teachers have the essential knowledge and skills to teach the TEKS to the state's public school students.

This manual is designed to help examinees prepare for the new TExES test in this field. Its purpose is to familiarize examinees with the competencies to be tested, test item formats, and pertinent study resources. Educator preparation program staff may also find this information useful as they help examinees prepare for careers as Texas educators.

If you have any questions after reading this preparation manual or you would like additional information about the new TExES tests or the educator standards, please visit the SBEC Web site at **www.sbec.state.tx.us**.

KEY FEATURES OF THE MANUAL

List of competencies that will be tested

Strategies for answering test items

Sample test items and answer key

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SECTION I

THE NEW TExES TESTS FOR TEXAS TEACHERS

As required by the Texas Education Code §21.048, successful performance on educator certification examinations is required for the issuance of a Texas educator certificate. Each TExES test is a criterion-referenced examination designed to measure the knowledge and skills delineated in the corresponding TExES test framework. Each test framework is based on standards that were developed by Texas educators and other education stakeholders.

Each newly developed TExES test is designed to measure the requisite knowledge and skills that an entry-level educator in this field in Texas public schools must possess. The tests include both individual, or stand-alone, test items (questions) and items that are arranged in clustered sets based on real-world situations faced by educators.

Development of the New TExES Tests

Committees of Texas educators and interested citizens guide the development of the new TExES tests by participating in each stage of the test development process. These working committees comprise Texas educators from public and charter schools, faculty from educator preparation programs, education service center staff, representatives from professional educator organizations, content experts, and members of the business community. The committees are balanced in terms of position, affiliation, years of experience, ethnicity, gender, and geographical location. The committee membership is rotated during the development process so that numerous Texas stakeholders may be actively involved. The steps in the process to develop the TExES tests are described below.

1. **Develop Standards.** Committees are established to recommend what the beginning educator should know and be able to do. Using the Texas Essential Knowledge and Skills (TEKS) as a focal point, draft standards are prepared to define the knowledge and skills required of the beginning educator.
2. **Review Standards.** Committees review and revise the draft standards. The revised draft standards are then placed on the SBEC Web site for public review and comment. These comments are used to prepare a final draft of the standards that will be presented to the SBEC Board for discussion, the State Board of Education (SBOE) for review and comment, and the SBEC Board for approval. Standards not based specifically on the TEKS, such as those for librarians and counselors, are proposed as rule by the SBEC Board; sent to the SBOE for its 90-day review; and, if not rejected by the SBOE, adopted by the SBEC Board.
3. **Develop Test Frameworks.** Committees review draft test frameworks that are based on the standards. These frameworks outline the specific competencies to be measured on the new TExES tests. The TExES competencies represent the critical components of the standards that can be measured with either a pencil-and-paper-based or computer-based examination, as appropriate. Draft frameworks are not finalized until after the standards are approved and the job analysis/content validation survey (see #4) is complete.

4. **Conduct Job Analysis/Content Validation Surveys.** A representative sample of Texas educators who practice in or prepare individuals for each of the fields for which an educator certificate has been proposed are surveyed to determine the relative job importance of each competency outlined in the test framework for that content area. Frameworks are revised as needed following an analysis of the survey responses.
5. **Develop and Review New Test Items.** The test contractor develops draft items that are designed to measure the competencies described in the test framework. Committees review the newly developed test items that have been written to reflect the competencies in the new test frameworks. Committee members scrutinize the draft items for appropriateness of content and difficulty; clarity; match to the competencies; and potential ethnic, gender, and regional bias.
6. **Conduct Pilot Test of New Test Items.** All of the newly developed test items that have been deemed acceptable by the item review committees are then administered to an appropriate sample of candidates for certification.
7. **Review Pilot Test Data.** Pilot test results are reviewed to ensure that the test items are valid, reliable, and free from bias.
8. **Administer New TExES Tests.** New TExES tests are constructed to reflect the competencies, and the tests are administered to candidates for certification.
9. **Set Passing Standard.** A Standard Setting Committee convenes to review performance data from the initial administration of each new TExES test and to recommend a final passing standard for that test. The SBEC considers this recommendation as it establishes a passing score on the test.

Taking the TExES Test and Receiving Scores

Please refer to the current TExES registration bulletin for information on test dates, sites, fees, registration procedures, and policies.

You will be mailed a score report approximately four weeks after each test you take. The report will indicate whether you have passed the test and will include:

- a total test *scaled* score. Scaled scores are reported to allow for the comparison of scores on the same content-area test taken on different test administration dates. The total scaled score is not the percentage of items answered correctly and is not determined by averaging the number of questions answered correctly in each domain.
  - — For all TExES tests, the score scale is 100–300 with a scaled score of 240 as the minimum passing score. This score represents the minimum level of competency required to be an entry-level educator in this field in Texas public schools.
- your performance in the major content domains of the test and in the specific content competencies of the test.
  - — This information may be useful in identifying strengths and weaknesses in your content preparation and can be used for further study or for preparing to retake the test.
- information to help you understand the score scale and interpret your results.

You will <u>not</u> receive a score report if you are absent or choose to cancel your score.

Additionally, unofficial score report information will be posted on the Internet on the score report date of each test administration. Information about receiving unofficial scores on the Internet, the score scale, and other score report topics may be found on the SBEC Web site at **www.sbec.state.tx.us**.

Educator Standards

Complete, approved educator standards are posted on the SBEC Web site at **www.sbec.state.tx.us**.

SECTION II

USING THE TEST FRAMEWORK

The Texas Examination of Educator Standards (TExES) test measures the content knowledge required of an entry-level educator in this field in Texas public schools. This manual is designed to guide your preparation by helping you become familiar with the material to be covered on the test.

When preparing for this test, you should focus on the competencies and descriptive statements, which delineate the content that is eligible for testing. A portion of the content is represented in the sample items that are included in this manual. These test questions represent only a *sample* of items. Thus, your test preparation should focus on the complete content eligible for testing, as specified in the competencies and descriptive statements.

Organization of the TExES Test Framework

The test framework is based on the educator standards for this field.

The content covered by this test is organized into broad areas of content called domains. Each domain covers one or more of the educator standards for this field. Within each domain, the content is further defined by a set of competencies. Each competency is composed of two major parts:

1. the *competency statement,* which broadly defines what an entry-level educator in this field in Texas public schools should know and be able to do, and
2. the *descriptive statements,* which describe in greater detail the knowledge and skills eligible for testing.

The educator standards being assessed within each domain are listed for reference at the beginning of the test framework, which begins on page 8. These are then followed by a complete set of the framework's competencies and descriptive statements.

An example of a competency and its accompanying descriptive statements is provided on the next page.

Sample Competency and Descriptive Statements

Agricultural Science and Technology 6–12

Competency:

The agricultural science and technology teacher understands the foundations of agricultural education.

Descriptive Statements:

The beginning teacher:

- Understands the philosophy and goals of agricultural education.
- Recognizes the scope of agriculture and its effects on society (e.g., impact of mechanization).
- Identifies historical events, recent developments, and major areas of research in agriculture and natural resource utilization.
- Knows concepts and terms used in agriculture and agricultural education and sources of information about agriculture, agricultural education, and agricultural careers.
- Knows characteristics and functions of agricultural education advisory committees, how to organize and work effectively with these committees, and how to encourage student, community, and industry involvement in agricultural education programs.
- Understands the use of scientific principles, methods, measurements, and calculations in agriculture and agricultural education.
- Understands legal and ethical issues related to agricultural education (e.g., ethical treatment of animals, liability for accidental injury).

Studying for the TExES Test

The following steps may be helpful in preparing for the TExES test.

1. Identify the information the test will cover by reading through the test competencies (see the following pages in this section). *Within each domain* of this TExES test, each competency will receive approximately equal coverage.

2. Read each competency with its descriptive statements in order to get a more specific idea of the knowledge you will be required to demonstrate on the test. You may wish to use this review of the competencies to set priorities for your study time.

3. Review the "Preparation Resources" section of this manual for possible resources to consult. Also, compile key materials from your preparation coursework that are aligned with the competencies.

4. Study this manual for approaches to taking the TExES test.

5. When using resources, concentrate on the key ideas and important concepts that are discussed in the competencies and descriptive statements.

NOTE: This preparation manual is the only TExES test study material endorsed by the SBEC for this field. Other preparation materials may not accurately reflect the content of the test or the policies and procedures of the TExES program.

TEST FRAMEWORK FOR FIELD 172: AGRICULTURAL SCIENCE AND TECHNOLOGY 6–12

Domain I **Foundations of Agricultural Education (approximately 22% of the test)**

Standards Assessed:

Agricultural Science and Technology 6–12 Standard I:
The agricultural science and technology teacher understands the foundations of agricultural education and applies procedures and practices to ensure the safety of all students in the classroom, laboratory, field, and supervised agricultural experience (SAE).

Agricultural Science and Technology 6–12 Standard II:
The agricultural science and technology teacher knows how to advise and assist students in career planning and development, work with community and industry representatives to support the agricultural program, and promote student development through supervised agricultural experiences, leadership development, and student organizations (e.g., FFA).

Domain II **Agribusiness and Economics (approximately 11% of the test)**

Standards Assessed:

Agricultural Science and Technology 6–12 Standard III:
The agricultural science and technology teacher understands and applies principles of economics and business management in agricultural enterprises.

Domain III **Plant and Soil Science (approximately 22% of the test)**

Standards Assessed:

Agricultural Science and Technology 6–12 Standard IV:
The agricultural science and technology teacher understands plant and soil science and applies principles and methods used in plant production and management.

Domain IV **Animal Science (approximately 17% of the test)**

Standards Assessed:

Agricultural Science and Technology 6–12 Standard V:
The agricultural science and technology teacher understands animal science and applies principles and methods used in animal production and management.

Domain V Agricultural Mechanics and Technology (approximately 17% of the test)

Standards Assessed:

Agricultural Science and Technology 6–12 Standard VI:
The agricultural science and technology teacher understands and applies principles and methods of agricultural mechanics, construction, and related technologies.

Agricultural Science and Technology 6–12 Standard VII:
The agricultural science and technology teacher has a basic understanding of biotechnology and genetic engineering and understands the use of computers and related technologies in agricultural production and management.

Domain VI Natural Resources and Environmental Science (approximately 11% of the test)

Standards Assessed:

Agricultural Science and Technology 6–12 Standard VIII:
The agricultural science and technology teacher understands and applies knowledge of environmental systems, natural resource management, and the effects of agriculture on the environment.

DOMAIN I—FOUNDATIONS OF AGRICULTURAL EDUCATION

Competency 001

The agricultural science and technology teacher understands the foundations of agricultural education.

The beginning teacher:

- Understands the philosophy and goals of agricultural education.
- Recognizes the scope of agriculture and its effects on society (e.g., impact of mechanization).
- Identifies historical events, recent developments, and major areas of research in agriculture and natural resource utilization.
- Knows concepts and terms used in agriculture and agricultural education and sources of information about agriculture, agricultural education, and agricultural careers.
- Knows characteristics and functions of agricultural education advisory committees, how to organize and work effectively with these committees, and how to encourage student, community, and industry involvement in agricultural education programs.
- Understands the use of scientific principles, methods, measurements, and calculations in agriculture and agricultural education.
- Understands legal and ethical issues related to agricultural education (e.g., ethical treatment of animals, liability for accidental injury).

Competency 002

The agricultural science and technology teacher understands and applies procedures and practices to ensure the safety of all students in the classroom and laboratory.

The beginning teacher:

- Applies procedures for selecting and maintaining equipment, materials, and technology used in the agricultural classroom and lab.
- Applies strategies for instructing students in the proper and safe use of materials, tools, and instruments, and for monitoring student behavior in the agricultural classroom and lab.
- Understands personal and occupational safety practices, including basic first aid, and appropriate practices for preventing and responding to accidents in the agricultural classroom and lab.
- Identifies potential hazards in the agricultural classroom and lab.
- Applies strategies for incorporating safety training into the agricultural education program and for developing and implementing safety plans for the agricultural classroom and lab.
- Identifies procedures for the proper use, storage, and disposal of hazardous materials (e.g., chemicals, petroleum products, biological waste products) used in the agricultural classroom and lab.
- Identifies sources of safety-related information (e.g., Material Safety Data Sheets, emergency response procedures) and federal, state, and local agencies, laws, and regulations concerned with maintaining safety in the agricultural classroom and lab.

Competency 003

The agricultural science and technology teacher understands how to advise and assist students in career planning and development and how to promote student development through supervised agricultural experiences (SAEs).

The beginning teacher:

- Identifies career development and entrepreneurship opportunities in the field of agriculture/agribusiness, and the knowledge and skills necessary for various careers in agriculture.
- Understands employers' expectations, appropriate work habits, good citizenship skills, and personal characteristics necessary for a successful career in modern agriculture.
- Applies strategies for assisting students in career planning and development and in applying for, obtaining, and maintaining employment in agriculture and related fields.
- Identifies the goals and purposes of SAEs; relationships among the agricultural classroom, lab, field, and SAE; and the characteristics of different types of SAEs (e.g., cooperative education, entrepreneurship, mentoring).
- Understands legal and ethical issues related to SAEs (e.g., child labor laws, validation issues).
- Applies strategies for coordinating SAEs; assisting students in planning, implementing, and managing their SAEs; and maintaining accurate records, assessing student progress, and evaluating the effectiveness of SAEs.

Competency 004

The agricultural science and technology teacher understands how to promote student growth through student leadership development organizations.

The beginning teacher:

- Knows the characteristics, functions, and organizational structures of student leadership development organizations (e.g., FFA).
- Applies strategies for developing a basic program of activities for a student development organization.
- Applies democratic principles and parliamentary procedure to conduct effective meetings of a student leadership development organization.
- Understands the roles and responsibilities that advisors have in these organizations and strategies for encouraging students.
- Applies strategies for planning, organizing, and conducting career development events (CDEs) and leadership development events (LDEs).

DOMAIN II—AGRIBUSINESS AND ECONOMICS

Competency 005

The agricultural science and technology teacher understands agricultural entrepreneurship, business management, and ethical issues in agricultural businesses.

The beginning teacher:

- Analyzes the role of entrepreneurship in agriculture, methods of entrepreneurial planning, and key factors for successful entrepreneurship.
- Identifies distinguishing characteristics and purposes of different types of organizational structures in agricultural businesses.
- Identifies steps in establishing an agricultural business, the components of a business plan, and decision-making and problem-solving methods in agricultural businesses.
- Understands basic principles and methods of financial management and types, characteristics, and purposes of budgets and record-keeping systems used in agricultural businesses.
- Understands the use of computer hardware and software applications (e.g., spreadsheet, database, communication) in agriculture-related tasks.
- Applies strategies for managing a diverse workforce (e.g., training and supervising personnel, fostering teamwork) and for ensuring respect for diversity in the workplace.
- Identifies agriculture-related government agencies and applies knowledge of work-related and business-related ethics to decision-making in agricultural businesses.

Competency 006

The agricultural science and technology teacher understands the application of economic and marketing principles to agricultural enterprises.

The beginning teacher:

- Understands key economic principles (e.g., risk, supply and demand, value added) in agricultural business and how to apply knowledge of economic principles to business-related decision making.
- Identifies factors that influence the pricing and sale of agricultural goods and services.
- Identifies factors (e.g., socioeconomic status, culture, age, gender) that influence consumer behavior.
- Understands and applies strategies for marketing agricultural products.
- Understands major global trends in food and fiber production, processing, distribution, and demand.
- Recognizes the impact of world markets on U.S. and Texas agriculture.

DOMAIN III—PLANT AND SOIL SCIENCE

Competency 007

The agricultural science and technology teacher understands and applies principles of soil science.

The beginning teacher:

- Knows the nature and properties of soil, processes of soil formation, and the importance of various soil constituents for plant growth.
- Identifies the components of soil, the physical and chemical properties of different soils, and methods of soil classification.
- Understands the importance of soil conservation, methods of soil conservation, and mechanical practices that reduce soil erosion.
- Identifies characteristics, advantages, and disadvantages of various methods of tillage and seedbed preparation.
- Applies knowledge of procedures for performing and interpreting basic soil tests (e.g., nutrient, organic content, pH) and for evaluating the suitability of different types of soil for the production of various crops.
- Applies knowledge of different types and formulations of fertilizers and other soil treatments.
- Understands methods and procedures for improving the quality of soil (e.g., adding fertilizers, lime, and organic matter; mulching).

Competency 008

The agricultural science and technology teacher understands basic plant classification, morphology, physiology, and genetics.

The beginning teacher:

- Recognizes the structure and function of plant parts (e.g., flowers, leaves, roots, stems) and how they differ among plant species.
- Understands plant classification and identifies distinguishing features of major plant groups (e.g., monocots, dicots).
- Understands basic physiological processes in plants (e.g., photosynthesis, respiration, transpiration, transport of nutrients).
- Understands the effects of various environmental factors (e.g., soil characteristics, light intensity, day length, temperature) on plant growth and development.
- Knows basic processes of plant reproduction, principles of plant genetics, and methods used in the sexual and asexual propagation of plants.
- Applies knowledge of principles, methods, and techniques of selective breeding and hybridization of plants.

Competency 009

The agricultural science and technology teacher understands basic crop production and management.

The beginning teacher:

- Identifies types, characteristics, and uses of major economic crops grown in Texas.
- Understands basic principles of plant production and management (e.g., soil preparation, water management, crop rotation).
- Knows basic principles and methods of disease, insect, and weed control (e.g., integrated pest management, chemical control, biological control) and the safe handling of pest management materials.
- Demonstrates basic knowledge of common nutrient deficiencies, diseases, weeds, and insect pests that affect crops.
- Recognizes basic principles of identifying and processing edible plant products.
- Applies knowledge of basic procedures for grading, packing, storing, and marketing plant products (e.g., grains, forage, fruits, vegetables, cotton).

Competency 010

The agricultural science and technology teacher understands ornamental horticulture and aquaculture.

The beginning teacher:

- Knows basic methods for managing the greenhouse and nursery environments (e.g., controlling temperature, moisture, humidity, pests).
- Applies basic procedures and techniques for propagating, transplanting, growing, and maintaining greenhouse and nursery plants.
- Understands basic principles of landscape design and management, and procedures and techniques for planning, establishing, and maintaining landscapes.
- Understands basic principles of floral design and techniques for preparing, handling, and storing flowers and decorative plants.
- Understands basic principles and procedures for production of aquaculture plants.

DOMAIN IV—ANIMAL SCIENCE

Competency 011

The agricultural science and technology teacher understands basic animal classification, anatomy, physiology, and genetics.

The beginning teacher:

- Identifies basic characteristics and uses of various breeds and types of animals of major economic importance in the United States.
- Knows the basic anatomy of major organs and organ systems (e.g., respiratory, digestive, skeletal, muscular) in various animals (e.g., cattle, horses, swine, poultry).
- Understands basic physiological processes (e.g., digestion, respiration, circulation) in various animals.
- Knows the stages of growth and development in various animals.
- Understands basic health issues and trends in the consumption of animal products in Texas and the United States.
- Understands basic principles of genetics and their application to animal reproduction and selective breeding.

Competency 012

The agricultural science and technology teacher understands animal production and management.

The beginning teacher:

- Demonstrates general knowledge of animal management procedures (e.g., immunizing, taking vital signs, restraining, medicating, performing common surgical procedures).
- Recognizes normal and abnormal behavior in various animals and its relationship to animal management.
- Understands care and safe handling of animals throughout the life cycle and legal and ethical considerations in animal production and management.
- Understands basic nutritional requirements of animals and applies knowledge of animal nutrition (e.g., sources of nutrients, classes of feed, feed additives) and feeding practices (e.g., formulating rations, issues of feed quality, feeding schedules).
- Identifies common nutrient deficiencies, disease symptoms, parasites, and genetic disorders of animals and methods of control, treatment, and prevention.
- Knows basic principles of animal reproduction and selective breeding and applies principles of genetics (e.g., EPDs, progeny data, trait selection) to selective breeding of animals.
- Applies basic knowledge of natural and artificial animal breeding practices (e.g., controlling mating, artificial insemination) and current technologies used in animal reproduction (e.g., embryo transfer).
- Evaluates breeding animals using various data (e.g., performance testing, production records, progeny testing, visual appraisal).
- Understands basic principles and procedures for animal aquaculture.

Competency 013

The agricultural science and technology teacher understands animal facilities, and procedures for selecting animals and processing animal products.

The beginning teacher:

- Identifies different types, characteristics, and purposes of animal facilities (e.g., barns, feedlots).
- Identifies appropriate environmental conditions (e.g., lighting, temperature, humidity) for housing various animals and methods of environmental control.
- Understands environmental issues associated with animal facilities and basic procedures for managing animal waste and maintaining sanitation.
- Knows guidelines for evaluating, purchasing, selling, and culling individual animals and how to use relevant information databases in making these decisions.
- Identifies basic sanitation procedures for handling, processing, and packaging edible animal products.

DOMAIN V—AGRICULTURAL MECHANICS AND TECHNOLOGY

Competency 014

The agricultural science and technology teacher understands and applies mechanical principles and power technology in agriculture.

The beginning teacher:

- Understands and applies basic safety procedures related to agricultural mechanics and related technologies.
- Identifies and uses personal safety equipment, and identifies hazards and safety needs in the home and workplace.
- Understands basic terms and principles related to simple machines, force, work, power, and electricity (e.g., volts, watts, amperes) as they apply to agriculture.
- Understands the design, components, and basic principles of operation of internal combustion engines and related power systems used in agriculture.
- Identifies and selects common tools, machinery, and equipment used in agriculture and demonstrates knowledge for their proper inspection, maintenance, and storage.
- Demonstrates knowledge of the safe and proper operation of agricultural tools, machinery, and equipment.

Competency 015

The agricultural science and technology teacher understands agricultural construction and metal fabrication.

The beginning teacher:

- Applies safety regulations, policies, procedures, and equipment to construction of agricultural structures, enclosures, and related systems.
- Applies knowledge of basic procedures for planning construction of agricultural structures and enclosures (e.g., locating sites, drawing plans, estimating materials and costs).
- Applies knowledge of basic construction principles, techniques, methods, tools, and materials (e.g., carpentry, concrete, plumbing, wiring) to construct agricultural structures and enclosures.
- Identifies commonly used metals, their properties and uses in agriculture, and basic principles and techniques for cutting, shaping, and joining metal for agricultural applications.
- Knows principles and techniques for safely performing basic metalworking procedures (e.g., cutting, filing, shaping, drilling, soldering, welding).
- Understands the design, components, and operation of electric circuits, motors, sensors, and control devices, and basic wiring procedures used in agriculture.
- Demonstrates knowledge of basic plumbing methods, tools, and materials and of heating and cooling, water supply, and sanitation systems.

Competency 016

The agricultural science and technology teacher understands biotechnology and the use of computers and related technologies in agricultural production and management.

The beginning teacher:

- Identifies basic applications of biotechnology in agriculture (e.g., cold tolerance, herbicide resistance).
- Identifies basic principles of cell biology and tissue culture.
- Demonstrates an understanding of basic laboratory techniques used in biotechnology and applies basic principles of DNA fingerprinting to genome mapping and marker-assisted selection and identification of crops and livestock.
- Demonstrates an awareness of social, economic, environmental, ethical, and legal issues in biotechnology.
- Knows how to use and access digital technology in agricultural record keeping (e.g., production records, breeding records, nutrient management, Internet resources).
- Recognizes the use of technological systems in agricultural sciences (e.g., Global Positioning Systems [GPS], Geographic Information Systems [GIS], remote sensing).
- Applies appropriate technologies to agricultural production and management (e.g., measuring crop yields, monitoring and controlling the greenhouse environment and irrigation systems, monitoring production of milk and eggs, formulating rations, using chip implants for identification).

DOMAIN VI—NATURAL RESOURCES AND ENVIRONMENTAL SCIENCE

Competency 017

The agricultural science and technology teacher understands ecological principles, natural resources, and the impact of agriculture on the environment.

The beginning teacher:

- Understands basic ecological principles and concepts (e.g., habitat, carrying capacity, ecological succession).
- Applies basic knowledge of environmental systems and cycles (e.g., carbon cycle, water cycle).
- Identifies types of renewable and nonrenewable natural resources.
- Identifies factors affecting the availability of natural resources and the effects of resource availability on agriculture.
- Applies knowledge of methods of conservation (e.g., energy efficiency, use of alternative fuels, recycling, runoff control, erosion control).
- Analyzes the interdependence of agriculture and the environment (e.g., effects of agriculture on land, air, and water; effects of environmental degradation on agricultural production).

Competency 018

The agricultural science and technology teacher understands principles of ecosystem management.

The beginning teacher:

- Understands basic principles and methods related to land, water, and air management and the sustainable use of resources.
- Identifies laws, regulations, and ethical issues relating to the use and management of ecosystems and natural resources (e.g., use restrictions, landowner property rights, stewardship).
- Understands types (e.g., cultivated land, rangeland, forest land, wetlands), characteristics, and management of agricultural ecosystems and develops and applies basic environmental management plans for managing these systems.
- Applies basic principles and methods of agricultural recreation management (e.g., forest, fish, wildlife).
- Analyzes the importance of habitat conservation.
- Applies knowledge of causes of soil erosion and methods of preventing and reversing soil erosion.
- Demonstrates awareness of the responsibilities of government agencies and public service organizations in relation to environmental conservation and management (e.g., USDA, underground water districts, boards of conservation, EPA, TCEQ, Texas Parks and Wildlife).

SECTION III

APPROACHES TO ANSWERING MULTIPLE-CHOICE ITEMS

The purpose of this section is to describe multiple-choice item formats that you will see on the TExES test in this field and to suggest possible ways to approach thinking about and answering the multiple-choice items. However, these approaches are not intended to replace familiar test-taking strategies with which you are already comfortable and that work for you.

The Agricultural Science and Technology 6–12 test is designed to include 80 scorable multiple-choice items and approximately 10 nonscorable items. Your final scaled score will be based only on scorable items. The nonscorable multiple-choice items are pilot tested by including them in the test in order to collect information about how these items will perform under actual testing conditions. Nonscorable test items are not considered in calculating your score, and they are not identified on the test.

All multiple-choice items on this test are designed to assess your knowledge of the content described in the test framework. The multiple-choice items assess your ability to recall factual information **and** to think critically about the information, analyze it, consider it carefully, compare it with other knowledge you have, or make a judgment about it.

When you are ready to respond to a multiple-choice item, you must choose one of four *answer choices* labeled A, B, C, and D. Then you must mark your choice on a separate answer sheet.

Item Formats

You may see the following two types of multiple-choice items on the test.

— Single items
— Items with stimulus material

You may have one or more items related to a single stimulus. When you have at least two items related to a single stimulus, the group of items is called a cluster. After the last item of a cluster, you will see the graphic illustrated below.

This graphic is used to separate these clustered items related to specific stimulus material from other items that follow.

On the following pages, you will find descriptions of these commonly used item formats, along with suggested approaches for responding to each type of item. In the actual testing situation, you may mark the test items and/or write in the margins of your test booklet, **but your final responses must be indicated on the answer sheet provided.**

SINGLE ITEMS

In the single-item format, a problem is presented as a direct question or an incomplete statement, and four answer choices appear below the item. The following item is an example of this type. It tests knowledge of Agricultural Science and Technology 6–12 competency 001: *The agricultural science and technology teacher understands the foundations of agricultural education.*

Which of the following developments in the 1960s and 1970s was most important in raising worldwide production of staple crops (e.g., wheat, rice, corn)?

A. creation of new high-yielding strains of grain

B. rapid growth of the organic farming movement

C. development of techniques for producing transgenic plants

D. payment of government subsidies to producers

Suggested Approach

Read the item carefully and critically. Think about what it is asking and the situation it is describing. Eliminate any obviously wrong answer choices, select the correct answer, and mark it on your answer sheet.

In the 1960s and 1970s, worldwide production of staple crops increased dramatically. This item asks which factor was most important in causing this increase. Look at the answer choices and consider which of them describes the most important development in raising production of staple crops during the specified period.

Option A suggests that the creation of new high-yielding strains of grain was most important in raising worldwide production of staple crops in the 1960s and 1970s. In fact, agricultural researchers during this period did develop several new strains of grains that had significantly higher yields per acre than strains that were in use before the period. These new varieties were planted heavily in many countries, particularly in India and other parts of Asia. The resulting increase in yields led to surpluses in several countries that had previously been net importers of food. Dr. Norman Borlaug, an American plant breeder, won a Nobel Peace Prize for his work in helping to lay the groundwork for what became known as the Green Revolution—the development and introduction of improved plant varieties. Option A may be the best response to this item.

Option B suggests that the rapid growth of the organic farming movement was most important in raising worldwide production of staple crops in the 1960s and 1970s. In fact, organic methods were used to grow staple crops in the developing world as a matter of necessity rather than choice. Yields using these methods were low, and crop losses to pests and weeds were high. Furthermore, the organic movement in developed countries focused primarily on growing non-staple vegetable and fruit crops on a small scale and had no effect on worldwide yields of staple crops. Option B may be eliminated as the best response to this item.

Option C suggests that the development of techniques for producing transgenic plants was most important in raising worldwide production of staple crops in the 1960s and 1970s. Transgenic plants are produced by inserting bits of DNA derived from another organism into the genome of a crop plant. Many transgenic, or "genetically modified", crops have been produced using these techniques. While use of transgenic plants has currently led to increased yields for some staple crops and promises to increase yields even more in the future, techniques for producing these plants were only developed quite recently and were not available in the 1960s and 1970s. Option C may be eliminated as the best response to this item.

Option D suggests that the payment of government subsidies to producers was most important in raising worldwide production of staple crops in the 1960s and 1970s. Payment of government subsidies to producers of agricultural products is a common practice in many developed countries. In general, however, these subsidies are paid to farmers as an incentive *not* to produce crops so that overproduction is avoided and prices remain stable. The net effect of these subsidies is to decrease, rather than increase, worldwide production of staple crops. Option D may be eliminated as the best response to this item.

Of the alternatives offered, only option A, creation of new high-yielding strains of grain, had an important effect on raising worldwide production of staple crops in the 1960s and 1970s. Therefore, the correct response is option A.

The following item is also in single-item format. It tests knowledge of Agricultural Science and Technology 6–12 competency 009: *The agricultural science and technology teacher understands basic crop production and management.*

To increase the amount of nitrogen in the soil, a farmer would most appropriately include which of the following crops in a crop rotation?

A. timothy

B. sunflowers

C. oats

D. alfalfa

Suggested Approach

Read the item carefully and critically. Think about what it is asking and the situation it is describing. Eliminate any obviously wrong answer choices, select the correct answer, and mark it on your answer sheet.

Farmers rotate crops for a number of reasons, including limiting the buildup of specific insect pests, increasing organic matter in the soil, and adding nitrogen to the soil. This item asks which crop a farmer would plant in order to increase nitrogen in the soil. Only crops that use symbiotic soil bacteria to fix atmospheric nitrogen (e.g., legumes) add significant amounts of nitrogen to the soil. Consider whether the crop identified in each answer choice can add significant amounts of nitrogen to the soil.

Option A suggests that planting timothy in a crop rotation will increase the amount of nitrogen in the soil. Timothy is a grass that is commonly grown and dried for hay. Although plowing under timothy will increase the amount of organic matter in the soil, timothy is not a legume, does not harbor symbiotic nitrogen-fixing bacteria, and will not increase the amount of nitrogen in the soil when used in a crop rotation. Option A may be eliminated as the best response to this item.

Option B suggests that planting sunflowers in a crop rotation will increase the amount of nitrogen in the soil. Sunflowers are members of the composite family and are commonly grown for seeds and oil. Although sunflowers are often planted in a crop rotation to break the development cycle of insect pests of other crops, sunflowers are not legumes, do not harbor symbiotic nitrogen-fixing bacteria, and will not increase the amount of nitrogen in the soil. Option B may be eliminated as the best response to this item.

Option C suggests that planting oats in a crop rotation will increase the amount of nitrogen in the soil. Oats are grasses that are commonly grown for their seeds. Although plowing under oat straw will increase the amount of organic matter in the soil, oats are not legumes, do not harbor symbiotic nitrogen-fixing bacteria, and will not increase the amount of nitrogen in the soil when used in a crop rotation. Option C may be eliminated as the best response to this item.

Option D suggests that planting alfalfa in a crop rotation will increase the amount of nitrogen in the soil. Alfalfa is a legume that is commonly grown and dried for hay or made into silage for use as a high-protein livestock feed. Since alfalfa is a legume and does harbor symbiotic nitrogen-fixing bacteria, planting alfalfa as part of a crop rotation will increase the amount of nitrogen in the soil. Option D is the best response to this item.

Of the alternatives offered, only alfalfa is capable of increasing the amount of nitrogen in the soil when used in a crop rotation. Therefore, the correct response is option D.

ITEMS WITH STIMULUS MATERIAL

Some items are preceded by stimulus material that relates to the items. Some types of stimulus material included on the test are reading passages, graphics, tables, or a combination of these. In such cases, you will generally be given information followed by an event to analyze, a problem to solve, or a decision to make.

One or more items may be related to a single stimulus. You can use several different approaches to respond to these types of items. Some commonly used approaches are listed below.

Strategy 1 Skim the stimulus material to understand its purpose, its arrangement, and/or its content, then read the item and refer again to the stimulus material to verify the correct answer.

Strategy 2 Read the item *before* considering the stimulus material. The content of the item will help you identify the purpose of the stimulus material and locate the information you need to respond to the item.

Strategy 3 Use a combination of both strategies: apply the "read the stimulus first" strategy with shorter, more familiar stimuli and the "read the item first" strategy with longer, more complex, or less familiar stimuli. You can experiment with the sample items in this manual and then use the strategy with which you are most comfortable when you take the actual test.

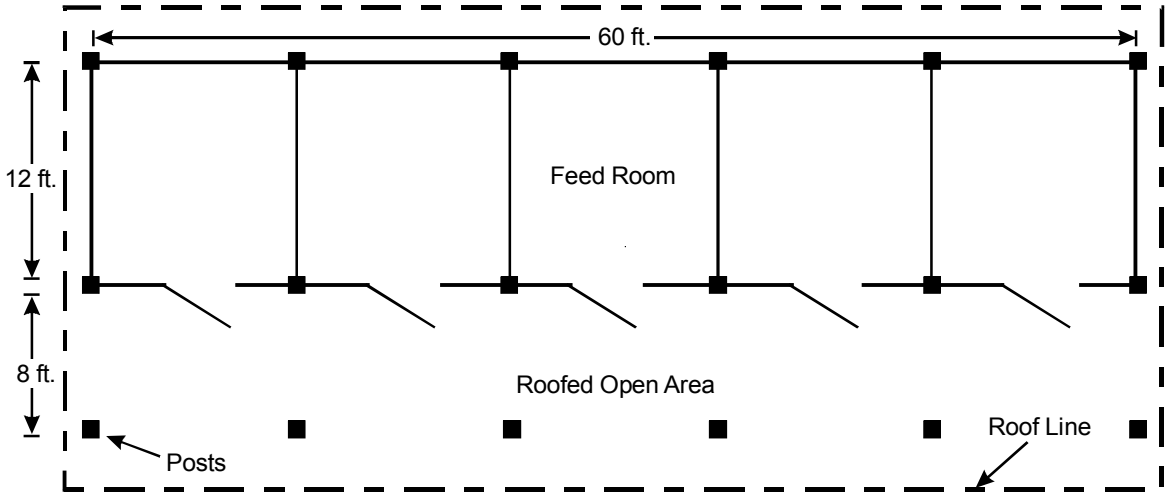
Whether you read the stimulus before or after you read the item, you should read it carefully and critically. You may want to underline its important points to help you respond to the item.

As you consider items set in educational contexts, try to use the teacher's point of view to respond to the items that accompany the stimulus. Be sure to consider the items in terms of only the information provided in the stimulus—not in terms of specific situations or individuals you may have encountered.

Suggested Approach

First review the stimulus (a floor plan for an animal housing facility).

Use the figure below to answer the question that follows.



Now you are ready to respond to the item or items associated with this stimulus. The item below tests knowledge of Agricultural Science and Technology 6–12 competency 013: *The agricultural science and technology teacher understands animal facilities and procedures for selecting animals and processing animal products.*

The facility in the figure above would most appropriately house which of the following animals?

A. beef cows

B. sows and their litters

C. show horses

D. dairy goats

Consider carefully the information given in the floor plan of the animal facility. According to the dimensions of the facility, each stall is twelve feet long and twelve feet wide. The facility is roofed and the stalls open into an unwalled area that is protected from the elements by an overhang or extension of the roof supported by posts. There are only four stalls, each having 144 square feet of space, and one feed room in the entire facility. This item asks which animal would most appropriately be housed in such a facility. Consider the answer choices and which of them identifies an animal that would most appropriately be housed in the facility.

Option A suggests that the facility shown in the figure would most appropriately be used for housing beef cattle. Beef cattle are often left out on the open range or in feedlots with no protection except windbreak fences or sunshades. They are sometimes raised in confinement facilities similar to the one shown, but they would not be housed in large, individual box stalls. Beef cattle housed in a cold confinement barn require about 30 square feet of space per head. A facility such as the one in the figure would not be an economical way to house beef cattle. Option A may be eliminated as the best response to this item.

Option B suggests that the facility shown in the figure would most appropriately be used for housing sows and their litters. Farrowing pens are much smaller than the stalls shown in the figure and would include a brooder for the piglets that the sow could not enter. Nursing pens would also be smaller than the individual stalls shown, as each sow and her litter requires about 40 square feet of space. A facility such as the one in the figure would not be an economical way to house sows and their litters. Option B may be eliminated as the best response to this item.

Option C suggests that the facility shown in the figure would most appropriately be used for housing show horses. Facilities for horses generally include a stable with individual box stalls such as the ones shown in the figure. Recommended sizes for stalls range from 100 square feet for ponies to 256 square feet for very large horses. Option C may be the best response to this item.

Option D suggests that the facility shown in the figure would most appropriately be used for housing dairy goats. Dairy goats are often left out in the open or housed in sheds. Dairy goats that are housed in sheds may be kept in loose pens or small individual stalls. With under 20 square feet of space typically provided, such stalls would be much smaller than the box stalls shown in the figure. Option D may be eliminated as the best response to this item.

Of the alternatives offered, only show horses would most appropriately be housed in the facility shown in the figure. Therefore, the correct response is option C.

SECTION IV

SAMPLE ITEMS

This section presents some sample test items for you to review as part of your preparation for the test. To demonstrate how each competency may be assessed, each sample item is accompanied by the competency number that it measures. While studying, you may wish to read the competency before and after you consider each sample item. Please note that the competency numbers will not appear on the actual test form.

An answer key follows the sample items. The answer key lists the item number and correct answer for each sample test item. Please note that the answer key also lists the competency assessed by each item and that the sample items are not necessarily presented in competency order.

The sample items are included to illustrate the formats and types of items you will see on the test; however, your performance on the sample items should not be viewed as a predictor of your performance on the actual test.

Competency 002

1. A majority of injuries in the agricultural classroom and laboratory are caused by:

   A. failure of protective gear or safety devices (e.g., shut-off switches, sprinklers).

   B. inadequate maintenance of tools and equipment.

   C. lack of adequate training of teachers in how to respond to accidents (e.g., first aid).

   D. unsafe behavior on the part of students or teachers.

Competency 002

2. Which of the following safety precautions would be most appropriate to take when working with volatile solvents, such as acetone, in the agricultural science and technology laboratory?

   A. wearing a paper mask when pouring or stirring the solvent

   B. not allowing the solvent to come into contact with water

   C. wearing a pair of latex gloves when pouring the solvent

   D. using proper ventilation when conducting activities that involve the solvent

Competency 003

3. Which of the following should be an important goal of a supervised agricultural experience (SAE)?

   A. The experience should promote sponsorship of the agricultural science and technology program by local businesses.

   B. The experience should give the student the chance to earn wages that are competitive with industry averages.

   C. The experience should support the educational objectives of the agricultural science and technology curriculum.

   D. The experience should focus on a career that requires a postsecondary education.

Competency 004

4. An advisor to a high school chapter of a student leadership development organization is helping chapter members develop a list of community service activities for the coming year. In developing this list, the advisor should ensure that the activities chosen:

   A. help chapter members make contacts in the community that will be useful in their future careers.

   B. present the chapter officers with the best opportunity to showcase their leadership skills.

   C. give all members of the chapter the opportunity to participate in community service.

   D. provide equal benefits to members of all groups present in the local community.

Competency 005

5. A grower who sells fresh strawberries to local restaurants and supermarkets discovers that the pond that provides water to irrigate the berries has been contaminated. Which of the following actions should the grower take first upon discovering this problem?

   A. Ask Environmental Protection Agency (EPA) representatives to shut down operations at the source of the contamination.

   B. Send samples of berries to an independent laboratory for testing.

   C. Stop selling the berries and notify local public health authorities.

   D. Seek legal counsel to determine the liability of the grower.

Competency 006

6. A vegetable grower markets her products through local farm stands and grocery stores. Information about the cultural groups that patronize these establishments would be most useful for helping the grower decide:

   A. when to plant each crop.

   B. which types of crops to plant.

   C. the wholesale price of each crop.

   D. how to package each crop.

Competency 007

7. A grower would most appropriately use which of the following formulations of fertilizer on a field that has adequate levels of nitrogen and potassium, but is deficient in phosphorus?

   A. 5-20-5

   B. 20-5-5

   C. 5-5-20

   D. 20-20-20

Competency 008

8. A plant that has thick, fleshy leaves that are covered by a waxy cuticle is likely to be better adapted than plants without such leaves for growing under which of the following conditions?

   A. dense shade

   B. cold temperatures

   C. low moisture

   D. high salinity

Competency 009

9. Post-harvest ripening of certain fruits and vegetables, such as tomatoes, can be facilitated by exposing them to:

   A. high temperatures.

   B. gibberellic acid.

   C. low humidity.

   D. ethylene gas.

Competency 010

10. Compared with tube, drip, or capillary mat systems, one disadvantage of using an overhead sprinkler system for watering foliage plants in a greenhouse is that such a system:

    A. is more likely to clog and require frequent maintenance.

    B. increases the possibility of spreading diseases such as mildew.

    C. leads to the build-up of high levels of salts in the growing medium.

    D. cannot be used for delivering fertilizer to plants.

Competency 011

11. In which of the following respects do the dietary needs of ruminant animals such as cattle differ from the needs of nonruminant animals?

    A. Ruminant animals are less efficient at absorbing water from their digestive tracts than nonruminant animals and therefore must ingest considerably more water with their feed.

    B. Ruminant animals are better able to manufacture calcium in their digestive tracts than nonruminant animals and therefore can tolerate a diet that is lower in calcium.

    C. Ruminant animals are less efficient at extracting nutrients from feed than nonruminant animals and therefore require a diet that is richer in both carbohydrates and protein.

    D. Ruminant animals can break down cellulose in their digestive tracts more effectively than nonruminant animals and therefore can tolerate a diet that is higher in fiber.

Competency 012

12. Which of the following methods of medicating large animals is most appropriate to use when a quick response is necessary to save the life of the animal?

    A. intravenous injection

    B. topical application

    C. oral administration of a bolus

    D. subcutaneous injection

Competency 014

13. A combine would be used most appropriately to perform which of the following tasks?

    A. soil preparation

    B. harvesting

    C. planting

    D. cultivating

Competency 016

14. **Use the information below to answer the question that follows.**

    Dairy cattle are herded into a holding area toward a milking parlor. Before being milked, they walk down a corridor where each cow passes a remote temperature sensor. The sensor controls gates which will open or close depending on the temperature of the cow. Cows with temperatures below a preset point will enter the milking parlor, while cows with temperatures above this point will be diverted into a second holding area.

    This system is most appropriate for which of the following purposes?

    A. identifying cows that have not been sufficiently milked

    B. detecting and isolating cows that are coming into estrus

    C. identifying cows that are stressed by the milking procedure

    D. detecting and isolating cows that may be sick

Competency 016

15. In biotechnology, which of the following procedures is used to identify proteins produced by specific genes?

    A. cloning

    B. cell culture

    C. genome mapping

    D. karyotyping

Competency 017

16. Salinization of soil is most likely to be a problem when:

    A. poorly drained land in an arid climate is irrigated over the course of several years.

    B. livestock manure is spread on farmland without being plowed back into the soil.

    C. chemical fertilizer is used for several years under conditions of high humidity and rainfall.

    D. fields are left uncovered by removing all crop residues and failing to plant a cover crop.

Competency 018

17. The primary goal of applying principles of sustainable agriculture to crop production on a farm is to:

    A. increase the ability of the farm to become self-sufficient by emphasizing the production of crops for personal use.

    B. retain the profitability of the farm while maintaining or enhancing environmental health and the productive capacity of the land.

    C. reduce the size of the farm so that it can be profitably worked by the farmer and members of his or her immediate family.

    D. control production on the farm so that oversupply of the farm's principal product does not result in depression of prices.

Item Number	Correct Answer	Competency
1	**D**	002
2	**D**	002
3	**C**	003
4	**C**	004
5	**C**	005
6	**B**	006
7	**A**	007
8	**C**	008
9	**D**	009
10	**B**	010
11	**D**	011
12	**A**	012
13	**B**	014
14	**D**	016
15	**C**	016
16	**A**	017
17	**B**	018

SECTION V

PREPARATION RESOURCES

The resources listed below may help you prepare for the TExES test in this field. These preparation resources have been identified by content experts in the field to provide up-to-date information that relates to the field in general. You may wish to use current issues or editions to obtain information on specific topics for study and review.

Journals

Agricultural Economics: The Journal of the International Association of Agricultural Economics

The Agricultural Education Magazine

Journal of Agricultural Education, American Association for Agricultural Education, http://pubs.aged.tamu.edu/jae

Journal of Natural Resources and Life Sciences Education, American Association for Agricultural Education, http://www.jnrlse.org/

Techniques: Connecting Education and Careers, Association for Career and Technology Education, http://www.acteonline.org/members/techniques/index.cfm

Other Sources

Cooper, E. L., and Burton, D. L. (2002). *Agriscience: Fundamentals and Applications*. Albany, NY: Thomson Delmar Learning.

Deal, K. H. (2003). *Wildlife and Natural Resource Management*. Clifton Park, NY: Thomson Delmar Learning.

Drummond, H. E., and Goodwin, J. W. (2004). *Agricultural Economics* (2nd ed.). Upper Saddle River, NJ: Prentice Hall.

Ekarius, C. (2004). *How to Build Animal Housing*. North Adams, MA: Storey Press.

Ess, D., and Morgan, M. (2003). *Precision Farming Guide for Agriculturalists*. Davenport, IA: John Deere Publishing.

Gillespie, J. R. (2004). *Modern Livestock and Poultry Production* (7th ed.). Clifton Park, NJ: Thomson Delmar Learning.

Herren, R. V., and Cooper, E. L. (2002). *Agricultural Mechanics: Fundamentals and Applications*. Albany, NY: Thomson Delmar Learning.

McMahon, M. J., Kofranek, A. M., and Rubatzky, V. (2002). *Hartmann's Plant Science* (3rd ed.). Upper Saddle River, NJ: Prentice Hall.

Plaster, E. J. (2003). *Soil Science and Management* (4th ed.). Clifton Park, NJ: Thomson Delmar Learning.

Poincelot, R. P. (2004). *Sustainable Horticulture Today and Tomorrow*. Upper Saddle River, NJ: Prentice Hall.

Nelson, P. V. (2003). *Greenhouse Operation and Management* (6th ed.). Upper Saddle River, NJ: Prentice Hall.

Online Resources

Agriculture in the Classroom, http://www.agclassroom.org/

AgrowKnowledge, The National Center for Agriscience and Technology Education, http://www.agroknowledge.org

Association for Career and Technology Education, http://www.acteonline.org/

National FFA Organization, http://www.ffa.org/index.html

United States National Agriculture Library, http://www.nal.usda.gov/