STATE BOARD FOR EDUCATOR CERTIFICATION/TEXAS EDUCATION AGENCY
TEXAS EDUCATOR CERTIFICATION
TExES/ExCET TOPT TExMaT TASC/TASC-ASL

TExES | Texas Examinations of Educator Standards

Preparation Manual

171 Technology Education 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 impact 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 questions

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 may 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 are comprised of 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 convened to recommend what the beginning educator should know and be able to do. To ensure vertical alignment of standards across the range of instructional levels, individuals with expertise in early childhood, elementary, middle, or high school education meet jointly to articulate the critical knowledge and skills for a particular content area. Participants begin their dialogue using a "clean slate" approach with the Texas Essential Knowledge and Skills (TEKS) as the focal point. Draft standards are written to incorporate the TEKS and to expand upon that content to ensure that all beginning educators possess the appropriate level of both knowledge and skills to instruct students successfully.
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 mailing date of each test administration. Information about receiving unofficial scores via 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

Technology Education 6–12

Competency:

The Technology Education teacher demonstrates knowledge of the nature and philosophy of technology and technology education and the interactions between technology and society.

Descriptive Statements:

The beginning teacher:

- Demonstrates knowledge of general characteristics of technology (e.g., technology involves innovation and creativity, technology products and systems alter the natural world and are designed to solve problems, there are limitations to technology's ability to solve problems, new technologies are built on previous technologies) and of the history and evolution of technology.
- Understands how factors (e.g., scientific advances, access to capital, market demand) affect the rate of technological development and how technology makes it possible for scientists to extend research and explore new phenomena.
- Understands how technological systems and subsystems interact to achieve common goals and understands the role of control mechanisms and redundancy in technological systems.
- Identifies resources needed to develop and support a technological system, the properties of those resources, and how those resources are used in technological systems.
- Understands career opportunities, requirements, and expectations (e.g., teamwork, leadership, integrity, honesty) in technology and applies principles of career planning and skills for job seeking.
- Understands how ethical, economic, political, environmental, and cultural considerations affect the development, selection, and use of technologies.
- Understands how technology affects humans in various ways (e.g., effects on safety, comfort, choices, attitudes; positive and negative social, cultural, political, and economic influences; connections between technology and various societal institutions) and understands the importance of having a technologically literate society.
- Understands the role of technology education in the world (e.g., how technology education helps students manage, use, and understand technology; how technology education provides hands-on experience to students; the difference between technology education and career and workforce development education).

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 171: TECHNOLOGY EDUCATION 6–12

Domain I **Fundamentals of Technology Education (approximately 17% of the test)**

Standards Assessed:

Technology Education 6–12 Standard I:
The technology education teacher understands the philosophy of technology education.

Technology Education 6–12 Standard II:
The technology education teacher understands the nature of technology.

Technology Education 6–12 Standard III:
The technology education teacher understands the interactions between technology and society.

Technology Education 6–12 Standard IV:
The technology education teacher understands technology and design processes.

Technology Education 6–12 Standard V:
The technology education teacher understands the use, maintenance, and impact of technology.

Technology Education 6–12 Standard VI:
The technology education teacher understands communication; manufacturing; construction; energy, power, and transportation; bio-related technology; and computer applications systems.

Technology Education 6–12 Standard VII:
The technology education teacher understands instructional development and facilities management.

Domain II **Communication (approximately 14% of the test)**

Standards Assessed:

Technology Education 6–12 Standard VI:
The technology education teacher understands communication; manufacturing; construction; energy, power, and transportation; bio-related technology; and computer applications systems.

Domain III **Manufacturing (approximately 17% of the test)**

Standards Assessed:

Technology Education 6–12 Standard VI:
The technology education teacher understands communication; manufacturing; construction; energy, power, and transportation; bio-related technology; and computer applications systems.

Domain IV Construction
(approximately 17% of the test)

Standards Assessed:

Technology Education 6–12 Standard VI:
The technology education teacher understands communication; manufacturing; construction; energy, power, and transportation; bio-related technology; and computer applications systems.

Domain V Energy, Power, and Transportation
(approximately 17% of the test)

Standards Assessed:

Technology Education 6–12 Standard VI:
The technology education teacher understands communication; manufacturing; construction; energy, power, and transportation; bio-related technology; and computer applications systems.

Domain VI Biotechnology and Computer Technology
(approximately 17% of the test)

Standards Assessed:

Technology Education 6–12 Standard II:
The technology education teacher understands the nature of technology.

Technology Education 6–12 Standard VI:
The technology education teacher understands communication; manufacturing; construction; energy, power, and transportation; bio-related technology; and computer applications systems.

DOMAIN I—FUNDAMENTALS OF TECHNOLOGY EDUCATION

Competency 001

The Technology Education teacher demonstrates knowledge of the nature and philosophy of technology and technology education and the interactions between technology and society.

The beginning teacher:

- Demonstrates knowledge of general characteristics of technology (e.g., technology involves innovation and creativity, technology products and systems alter the natural world and are designed to solve problems, there are limitations to technology's ability to solve problems, new technologies are built on previous technologies) and of the history and evolution of technology.
- Understands how factors (e.g., scientific advances, access to capital, market demand) affect the rate of technological development and how technology makes it possible for scientists to extend research and explore new phenomena.
- Understands how technological systems and subsystems interact to achieve common goals and understands the role of control mechanisms and redundancy in technological systems.
- Identifies resources needed to develop and support a technological system, the properties of those resources, and how those resources are used in technological systems.
- Understands career opportunities, requirements, and expectations (e.g., teamwork, leadership, integrity, honesty) in technology and applies principles of career planning and skills for job seeking.
- Understands how ethical, economic, political, environmental, and cultural considerations affect the development, selection, and use of technologies.
- Understands how technology affects humans in various ways (e.g., effects on safety, comfort, choices, attitudes; positive and negative social, cultural, political, and economic influences; connections between technology and various societal institutions) and understands the importance of having a technologically literate society.
- Understands the role of technology education in the world (e.g., how technology education helps students manage, use, and understand technology; how technology education provides hands-on experience to students; the difference between technology education and career and workforce development education).

Competency 002

The Technology Education teacher understands the design process and its application in technology.

The beginning teacher:

- Understands the steps in the design process and recognizes the design process as a systematic, iterative method of solving problems.
- Understands factors (e.g., human and personal characteristics, principles of ergonomics, meeting specific needs such as those of people with special needs) that influence a design and factors (e.g., efficiency, reliability, functionality) that influence the quality of a product.
- Knows how to describe, develop, and analyze technological products and systems that incorporate quality, reliability, and safety using the universal systems model (i.e., input, process, output, feedback) and appropriate design processes and techniques.
- Knows how to evaluate a design in terms of given criteria (e.g., functionality, aesthetics, marketability) and recognizes trade-offs associated with technology and the need for compromises among competing factors in the design process.
- Knows how to use a variety of models (e.g., physical, mathematical, computer) and other methods to develop optimal designs for technological products.
- Understands methods for communicating designs to others.
- Identifies the chemical, mechanical, and physical properties of materials.
- Applies mathematics, natural science, and social science to analyze technology and applies processes and problem-solving methods (e.g., processes and methods from science, engineering, mathematics) to solve technological problems.

Competency 003

The Technology Education teacher demonstrates knowledge of the uses and impacts of technology and techniques for maintaining technology systems.

The beginning teacher:

- Understands how technology systems may be used to meet specific goals.
- Demonstrates knowledge of appropriate codes, laws, standards, and regulations related to technology (e.g., Occupational Safety and Health Administration, American Society for Testing and Materials, Environmental Protection Agency, National Electrical Code).
- Identifies emerging technologies and their characteristics and recognizes their role in the evolution of technology.
- Knows how to collect, use, and evaluate manuals, protocols, and other resources to learn and understand how technologies function.
- Knows how to create maintenance plans and programs and recognizes the importance of proper maintenance and the consequences of improper maintenance.
- Applies strategies and procedures for maintaining safe and proper functioning of tools, equipment, and machines.
- Applies procedures for handling and storing tools and materials and for operating technological systems so that they function in the way they were designed.
- Knows how to troubleshoot technological systems and determine causes of failure in materials, tools, equipment, and machines.
- Applies procedures for repairing systems that are malfunctioning.

Competency 004

The Technology Education teacher knows how to plan, produce, and manage a technology systems project.

The beginning teacher:

- Understands how to plan, produce, and manage a communication project using appropriate resources, technical processes, and the basic communication model.
- Understands how to plan, produce, and manage a manufacturing project using appropriate resources and technical processes.
- Understands how to plan, produce, and manage a construction project using appropriate resources and technical processes.
- Understands how to plan, produce, and manage an energy, power, and transportation project using appropriate resources and technical processes.
- Understands how to plan, produce, and manage a bio-related technology project using appropriate resources and technical processes.
- Understands how to plan, produce, and manage a computer applications project using appropriate resources and technical processes.

Competency 005

The Technology Education teacher demonstrates knowledge of the philosophy of technology education; knows how to develop and implement a technology education program; and knows how to plan, manage, and maintain technology education facilities.

The beginning teacher:

- Knows how to assess and prioritize the facility-related needs of a technology education program (e.g., solicit and evaluate input from stakeholders, ensure that the space and physical arrangement of instructional facilities are conducive to effective instruction).
- Identifies characteristics (including advantages and disadvantages) of a variety of layouts for instructional facilities.
- Applies procedures for ensuring that instructional facilities are accessible to individuals with special needs.
- Knows how to identify and use sources of information about regulations and guidelines (e.g., space requirements, environmental control, safety equipment) for the construction and use of instructional facilities in technology education.
- Knows how to maintain instructional facilities for the technology education program and how to develop schedules for inspecting tools and equipment and for performing routine maintenance.
- Knows how to access information pertaining to the installation, maintenance, and repair of equipment used in technology education facilities.
- Knows how to identify, select, and acquire tools, equipment, and materials (e.g., computer hardware and software, multimedia equipment, power tools) used in the technology education program.
- Understands methods of effective financial planning and management (e.g., identifying funding sources; procedures related to accounting, auditing, reporting, and keeping inventory records).
- Demonstrates knowledge of methods and procedures for maintaining a safe instructional facility (e.g., identifying sources of safety-related information, evaluating safety hazards, maintaining a safe and clean learning environment, providing safety instruction) and for responding to emergencies (e.g., recognizing appropriate responses to given emergencies, identifying procedures for using safety equipment).

DOMAIN II—COMMUNICATION

Competency 006

The Technology Education teacher demonstrates knowledge of drafting.

The beginning teacher:

- Knows how to select and use tools and materials for sketching and for technical drawing.
- Applies technical drawing conventions to produce and interpret drawings (e.g., multiview drawings, sectional views, pictorial representations, detail and assembly drawings).
- Knows how to create working drawings, presentation drawings, and models for residential, community, and business needs.
- Understands the use of scales and dimensioning skills in producing and interpreting technical drawings.
- Knows how to use software related to technical drawing.

Competency 007

The Technology Education teacher demonstrates knowledge of equipment and techniques used in graphic design, photography, and image transfer and reproduction.

The beginning teacher:

- Understands principles (e.g., perspective, shading, balance, proportion, harmony), elements (e.g., line, form, color), and applications (e.g., architectural, engineering) of graphic design.
- Demonstrates knowledge of equipment (e.g., input devices, output devices) and software (e.g., common characteristics of desktop publishing software, issues related to compatibility between software packages) used in desktop publishing.
- Demonstrates knowledge of skills (e.g., word processing, illustrating, layout) used in desktop publishing.
- Understands principles of photographic composition (e.g., lighting, perspective, focus) and how to select and use photographic equipment and materials.
- Applies techniques and processes related to photography (e.g., computer manipulation of images, product finishing processes).
- Knows how to select and use materials related to image transfer and reproduction.
- Understands techniques and processes related to image carrier preparation, transfer, and reproduction.

Competency 008

The Technology Education teacher demonstrates knowledge of video and audio systems (e.g., radio, television), production techniques (e.g., recording, editing), and equipment (e.g., amplifiers, video cameras).

The beginning teacher:

- Demonstrates knowledge of equipment used in video and audio production (e.g., cameras, microphones, mixers, amplifiers, lighting equipment) and of how this equipment is interconnected in recording systems.
- Understands skills and techniques used in video and audio recording.
- Understands skills used to manipulate video and audio files (e.g., video and audio editing techniques; file compression schemes; procedures for integrating video, audio, animation, and special effects) and techniques for maintaining image and sound integrity during postproduction).

Competency 009

The Technology Education teacher demonstrates knowledge of electronic communication.

The beginning teacher:

- Understands scientific and technological concepts related to electronic communication.
- Demonstrates knowledge of materials and components used in electronic communication systems (e.g., satellite dishes, transmitters, receivers, uplinks, downlinks).
- Understands processes involved in electronic communication (e.g., how electromagnetic, satellite, and laser communication technologies send, transmit, and receive messages).

DOMAIN III—MANUFACTURING

Competency 010

The Technology Education teacher demonstrates knowledge of types of manufacturing systems and of the organization, structure, and management of manufacturing enterprises.

The beginning teacher:

- Demonstrates knowledge of types of manufacturing systems (e.g., custom, repetitive).
- Identifies types of organizational structures used in manufacturing enterprises and their characteristics.
- Understands how workforce organization and management structure can influence technological development.

Competency 011

The Technology Education teacher demonstrates knowledge of the principles of product development and of the application of economic and marketing principles to manufacturing.

The beginning teacher:

- Understands marketing processes and techniques and their use in preparing a marketing plan for an idea, product, or service.
- Demonstrates knowledge of financial factors associated with starting and operating manufacturing enterprises.
- Understands how competition, economic investment, risk, and the potential for economic reward influence the process of technological innovation and production.
- Applies economic and marketing principles (e.g., cost-price relationships, supply and demand) to manufacturing.
- Demonstrates knowledge of principles of product development (e.g., design, prototype construction, testing).

Competency 012

The Technology Education teacher understands how to use tools and equipment in manufacturing.

The beginning teacher:

- Identifies types and characteristics of tools and equipment (e.g., micrometers, milling machines, lathes, jigs and fixtures, saws, drills, welding machines, computer numerical control machines) used in manufacturing.
- Knows how to use tools and equipment used in manufacturing.
- Knows how to maintain and adjust tools and equipment used in manufacturing.
- Understands safety issues related to the maintenance and use of tools and equipment used in manufacturing.

Competency 013

The Technology Education teacher demonstrates knowledge of materials used in manufacturing.

The beginning teacher:

- Identifies types and properties (e.g., elasticity, ductility, corrosion resistance) of raw materials used in manufacturing.
- Compares and contrasts the structure and properties of natural, synthetic, and composite materials.
- Knows how to select appropriate materials for a given manufacturing application.

Competency 014

The Technology Education teacher demonstrates knowledge of manufacturing processes and quality control procedures.

The beginning teacher:

- Demonstrates knowledge of processes used in manufacturing (e.g., casting, molding, forming, separating, conditioning, assembling, finishing).
- Demonstrates knowledge of the uses of automated systems (e.g., robotics, artificial intelligence, computer integrated manufacturing) in technology.
- Knows how to apply quality control procedures in manufacturing.

DOMAIN IV—CONSTRUCTION

Competency 015

The Technology Education teacher demonstrates knowledge of types of construction projects, procedures for planning, surveying and preparing sites for construction projects, and postconstruction activities.

The beginning teacher:

- Identifies types (e.g., residential, civil, commercial) and characteristics of construction projects.
- Understands how to plan, produce, and manage a construction systems project.
- Understands how to prepare a site for a construction project.
- Demonstrates knowledge of surveying tools and equipment and their uses.
- Reads and interprets documents (e.g., survey reports, construction plans, zoning restrictions, building codes, environmental regulations) related to construction projects.
- Understands procedures related to postconstruction activities (e.g., site cleanup, waste disposal, landscaping) at a construction site.

Competency 016

The Technology Education teacher knows how to apply engineering principles to construction projects.

The beginning teacher:

- Identifies terms and concepts used in engineering.
- Applies engineering principles (e.g., tension, shear) to solve problems related to construction projects.
- Analyzes the structural properties of construction designs (e.g., truss, cantilever, arch, suspension).

Competency 017

The Technology Education teacher understands how to use hand and power tools in construction.

The beginning teacher:

- Identifies types and characteristics of measuring devices, hand tools, and power tools and equipment (e.g., rules, saws, drills, levels, cranes, backhoes) used in construction.
- Knows how to use measuring devices, tools, and equipment used in construction.
- Knows how to maintain and adjust tools and equipment used in construction.
- Understands safety issues related to the maintenance and use of tools and equipment used in construction.
- Understands the safe and proper use of tools and equipment used in construction.

Competency 018

The Technology Education teacher demonstrates knowledge of construction materials and their properties.

The beginning teacher:

- Identifies types and properties (e.g., moisture content, strength, hardness, oxidation) of raw materials (e.g., wood, steel, concrete, masonry, glass) used in construction.
- Compares and contrasts the properties of materials used in construction.
- Knows how to select appropriate materials for a given construction application.

Competency 019

The Technology Education teacher demonstrates knowledge of skills and techniques used for building, maintaining, and repairing structures.

The beginning teacher:

- Demonstrates knowledge of skills and techniques used for building structures.
- Demonstrates knowledge of skills and techniques used for maintaining and repairing structures.
- Demonstrates knowledge of skills and techniques related to framing (e.g., platform framing, post and beam) and roofing.
- Demonstrates knowledge of subsystems (e.g., HVAC, plumbing, electrical) in construction projects.

DOMAIN V—ENERGY, POWER, AND TRANSPORTATION

Competency 020

The Technology Education teacher demonstrates knowledge of scientific concepts related to energy and power.

The beginning teacher:

- Identifies scientific concepts and principles (e.g., conservation of energy, mechanical advantage, Pascal's principle, Bernoulli's principle) related to energy and power.
- Identifies types of energy (e.g., chemical, electrical) and methods of converting one form of energy to another (e.g., gas turbine, internal combustion engine, photovoltaic cell).
- Applies concepts and units of force, work, energy, and power to solve problems in technology.
- Applies scientific concepts and principles to solve problems related to energy, power, and transportation systems.

Competency 021

The Technology Education teacher understands issues related to energy consumption and conservation.

The beginning teacher:

- Identifies sources, availability, and uses of renewable (e.g., solar, wind) and nonrenewable (e.g., coal, oil) energy.
- Understands issues (e.g., consumer choices, costs, impact on the environment) related to conserving natural resources and promoting sustainable development through techniques such as reusing, reducing, and recycling.
- Demonstrates knowledge of processes used in extraction, production, transportation, and storage of energy resources.

Competency 022

The Technology Education teacher understands characteristics of thermal, electrical, fluid, and mechanical power systems and methods of control, transmission, and storage of energy and power.

The beginning teacher:

- Identifies characteristics of thermal, electrical, fluid, and mechanical power systems.
- Demonstrates knowledge of methods of control, transmission, and storage of energy and power (e.g., pneumatic and hydraulic systems, flywheels, batteries, dams).
- Analyzes the design of thermal, electrical, fluid, and mechanical power systems and recognizes advantages and disadvantages of systems designed for given functions.
- Understands the role of mechanical parts such as levers, cams, gear trains, belts, and pulleys in controlling and transmitting power.

Competency 023

The Technology Education teacher demonstrates knowledge of principles and applications of electronics.

The beginning teacher:

- Identifies types and characteristics of basic electronic components (e.g., resistors, inductors, transistors).
- Interprets schematic diagrams (e.g., determines function of a given circuit, determines the role of components in circuits) of AC and DC circuits and of analog and digital circuits.
- Analyzes voltage, resistance, current, and power in series and parallel AC and DC circuits.
- Relates the operating principles of motors, meters, transformers, and generators to basic principles of electricity and magnetism.

Competency 024

The Technology Education teacher demonstrates knowledge of the design and use of vehicles and vehicular subsystems and the characteristics of land, air, water, and space transportation systems.

The beginning teacher:

- Identifies the characteristics of land, air, water, and space transportation systems and their economic, safety, and environmental impacts.
- Demonstrates knowledge of issues related to the design and use of vehicles (e.g., airplanes, trains, automobiles) and vehicular subsystems (e.g., powertrains, suspensions).
- Understands aerodynamic principles related to the design of transportation vehicles.

DOMAIN VI—BIOTECHNOLOGY AND COMPUTER TECHNOLOGY

Competency 025

The Technology Education teacher understands the role of biotechnology in business, industry, and society.

The beginning teacher:

- Demonstrates knowledge of applications of bio-related technologies in business and industry.
- Demonstrates knowledge of ethical and legal considerations associated with the selection, development, and use of bio-related technologies, including emerging and innovative technologies.
- Identifies the intended and unintended effects of bio-related technology (e.g., effect of hazardous waste on the environment, social and economic effects of bio-related technologies) and strategies for assessing risks and benefits of bio-related technologies.

Competency 026

The Technology Education teacher demonstrates knowledge of principles of bio-related technologies.

The beginning teacher:

- Understands the scientific principles of bio-related technologies.
- Demonstrates knowledge of principles and methods used in environmental engineering.
- Understands issues related to renewable and nonrenewable resources.
- Demonstrates knowledge of tools, equipment, and materials used in bio-related technologies.

Competency 027

The Technology Education teacher demonstrates knowledge of basic principles related to computer technology.

The beginning teacher:

- Identifies types, characteristics, and functions of computer hardware (e.g., server, router, video card, hub, modem), software applications (e.g., spreadsheets, firewall software, database management software, FTP client), and operating systems.
- Understands basic concepts of computer network architecture (e.g., LAN, WAN, Internet) and principles of data transfer within and between computer networks (e.g., role of network protocols such as TCP/IP).
- Knows how to perform routine installation, maintenance, and troubleshooting procedures for stand-alone computers and computer networks.
- Understands the role of computer programs and computer languages in computer technology.

Competency 028

The Technology Education teacher understands appropriate and effective uses of computer technology.

The beginning teacher:

- Understands computer system requirements for given applications.
- Identifies characteristics and uses of a variety of computer software applications (e.g., productivity, graphic design, modeling, multimedia, authoring).
- Demonstrates knowledge of issues (e.g., ethical, legal, commercial, privacy) related to security (e.g., use of firewalls and virus-protection software, passwords and log on procedures and protocols) and the use of computer technology to transfer and access information.

SECTION III

APPROACHES TO ANSWERING MULTIPLE-CHOICE ITEMS

The purpose of this section is to describe multiple-choice item formats that you may 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 Technology Education 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 questions 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 questions on this test are designed to assess your knowledge of the content described in the test framework. The multiple-choice questions 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 answer a multiple-choice question, 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 questions on the test.

— Single items
— Items with stimulus material

You may have two or more items related to a single stimulus. This group of items is called a cluster. Following the last item of a clustered item set containing two or more items, 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 answering 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 response 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 question. The following question is an example of this type. It tests knowledge of Technology Education 6–12 competency 010: *The Technology Education teacher demonstrates knowledge of types of manufacturing systems and of the organization, structure, and management of manufacturing enterprises.*

Which of the following is an important advantage of the total quality management (TQM) system in manufacturing?

A. The decision process is made more efficient by its being centralized in a small group of individuals.

B. Workers in all departments take responsibility for quality assurance issues and design changes.

C. Quality control is monitored by specialists who are authorized to make managerial decisions.

D. Every aspect of manufacturing and design is closely monitored by sensors and other recording equipment.

Suggested Approach

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

This question requires knowledge of the use of total quality management (TQM) in manufacturing. TQM emphasizes continuous improvement in all areas of a company's operation by integrating systems, decentralizing decision making, and empowering employees at all levels of the company. Now look at the response options and consider which of them best describes one advantage of the total quality management system in manufacturing.

Option A suggests that one advantage of total quality management is centralized decision making. Total quality management, however, relies on decentralized decision making by encouraging the active participation of all employees at all levels to ensure quality control. Therefore, option A is not an advantage of the total quality management system and is not the best response for this item.

Option B suggests that one advantage of total quality management is allowing employees in all departments to take responsibility for decisions about quality issues. Decentralized decision making and employee empowerment are important goals of the total quality management system because quality control problems can often be more effectively identified and corrected by nonmanagers who are most familiar with the production processes in their departments. Thus option B would correctly identify one advantage of the total quality management system.

Option C suggests that one advantage of total quality management is the use of specialists who are authorized to make management decisions. This centralization of the decision-making process is contrary to the use of decentralized decision making and employee empowerment characteristic of total quality management systems. Therefore, option C is not an advantage of the total quality management system and is not the best response for this item.

Option D suggests that one advantage of total quality management is the use of sensors and recording equipment to monitor quality. While such devices may be used to help ensure quality control, total quality management is primarily a system for encouraging the participation of all employees in ensuring quality at all levels of the operation. Therefore, option D is not an advantage of the total quality management system and is not the best response for this item.

Of the alternatives offered, only allowing workers in all departments to take responsibility for quality assurance issues and design changes is an advantage of the total quality management system in manufacturing. Therefore, the correct response is option B.

ITEMS WITH STIMULUS MATERIAL

Some questions are preceded by stimulus material that relates to the item. 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 answer these types of questions. 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 answer the question.

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.

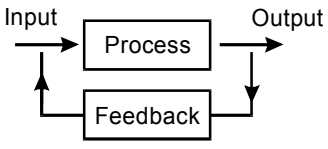
Whether you read the stimulus before or after you read the item, you should read it carefully and critically. You may want to underline its important points to help you answer the item.

As you consider items set in educational contexts, try to use the teacher's point of view to answer 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 read the stimulus (a diagram of the universal systems model).

Use the diagram below to answer the question that follows.



Now you are prepared to address the question associated with this stimulus. The question measures knowledge of Technology Education 6–12 competency 002: *The Technology Education teacher understands the design process and its application in technology.*

The diagram above best represents which of the following systems?

A. An electric fan that has two speeds: high and low.

B. A security camera that films video on a continuous loop.

C. A windmill with a fantail that turns the rotor into the wind.

D. An outdoor light with a timer that turns on and off at preset times.

Consider carefully the diagram of the universal systems model presented in the stimulus. Then read the question that asks you to identify which of four systems is best represented by the model shown in the diagram. Now look at the response options.

Option A suggests that the model best represents an electric fan that has two speeds. An electric fan has input (e.g., electricity), process (e.g., the action of the motor to rotate the blades of the fan) and output (e.g., moving air), but lacks a feedback device (e.g., a thermostat). Therefore, option A is not the best response to this question.

Option B suggests that the model best represents a security camera that films video on a continuous loop. Such a system has input (e.g., light), process (e.g., converting the light to images on the film), and output (e.g., images on the film), but lacks a feedback device (e.g., a motion sensor that turns the film on and off). Therefore, option B is not the best response to this question.

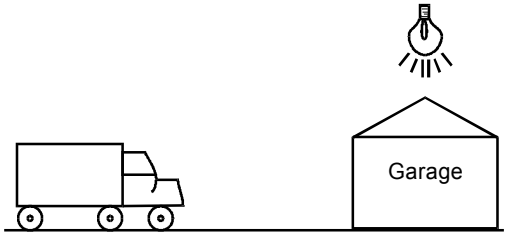
Option C suggests that the model best represents a windmill with a fantail that turns the rotor into the wind. Such a windmill has input (e.g., wind), process (e.g., turning of the rotor by the wind), and output (e.g., electrical or mechanical energy). In addition, the fantail is a feedback device that adjusts input by turning the rotor into the wind when wind direction changes. Therefore, option C correctly identifies a system that is represented by the model presented in the diagram.

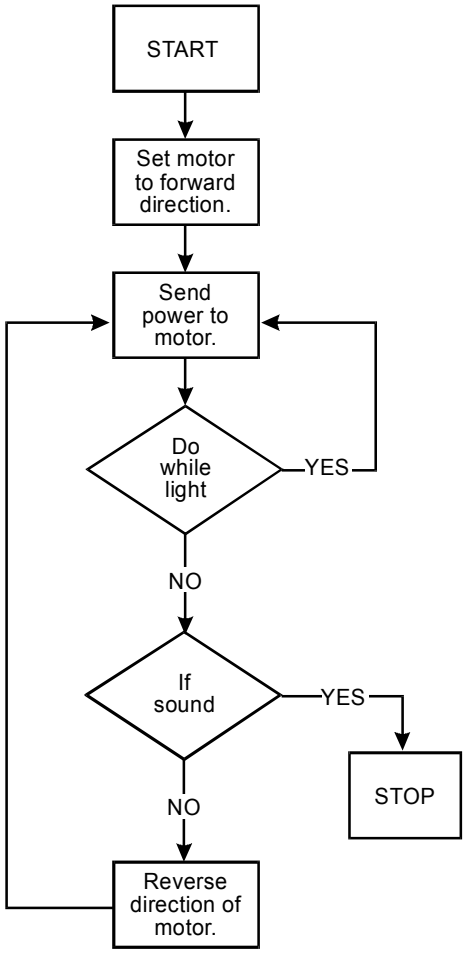
Option D suggests that the model best represents an outdoor light with a timer that turns on and off at preset times. Such a light has input (e.g., electricity), process (e.g., the production of light from electricity), and output (e.g., light), but lacks a feedback device (e.g., a light sensor that turns the light on or off at dusk or dawn regardless of the time). The timer is not a feedback device because it adjusts input according to a predetermined period of time rather than to variations in environmental conditions. Therefore, option D is not the best response to this question.

Of the four options offered, option C identifies a system that is best represented by the model presented in the diagram.

Now read the stimulus of this item (a diagram and flowchart of the response of a robotic truck to light and sound).

Use the diagram and flowchart below to answer the question that follows.





Now you are prepared to address the question associated with this stimulus. The question measures knowledge of Technology Education 6–12 competency 027: *The Technology Education teacher demonstrates knowledge of basic principles related to computer technology.*

The robotic truck in the diagram contains a sound sensor and a light sensor. The table on which the truck is placed is well lit by a light bulb. The garage, which has an opening through which the truck can enter, is dark inside. The operator of the robotic truck has a whistle that can be used to activate the truck's sound sensor. The truck begins in the position shown in the diagram. Which of the following should occur if the operator blows the whistle continuously?

A. The truck will go forward, enter the garage, reverse direction, then run backwards indefinitely.

B. The truck will go forward, enter the garage, then stop.

C. The truck will go a short distance forward, then stop without reaching the garage.

D. The truck will remain in its starting position without moving.

Consider carefully the diagram and flowchart presented in the stimulus. Then read the question which asks you to correctly identify how the truck will act if the operator blows the whistle continuously. Now look at the response options.

Option A suggests that the truck will go forward, enter the garage, reverse direction, then run backwards indefinitely. According to the flowchart, the truck motor will first be set to the forward direction and power will be sent to the motor. This will cause the truck to move forward and enter the garage. Since the garage is dark, power is no longer sent to the motor. According to the flow chart, the truck will only reverse direction if there is no sound. Since the whistle is blowing continuously, the truck will not reverse direction. Therefore, response A is incorrect.

Option B suggests that the truck will go forward, enter the garage, and then stop. As in response A, the truck motor will first be set to the forward direction, power will be sent to the motor, and the truck will move forward and enter the garage. Since the garage is dark, power will no longer be sent to the motor. According to the flowchart, the truck will stop with the whistle blowing continuously. Therefore, response B correctly describes the action of the truck according to the diagram and flowchart, with the whistle blowing continuously.

Option C suggests that the truck will go a short distance forward, then stop without reaching the garage. As in response A, the truck motor will first be set to the forward direction and power will be sent to the motor. According to the flowchart, the truck will continue to move forward until it is dark. Since it is not dark until the truck enters the garage, the truck will not stop before it enters the garage. Therefore, response C is incorrect.

Option D suggests that the truck will remain in its starting position without moving. According to the flowchart, however, power will be sent to the motor and the truck will move forward if there is light. Since there is light outside the garage, the truck will move forward until it is in the garage. Therefore, response D is incorrect.

Of the four options offered, option B best describes the action of the truck according to the diagram and flowchart, with the whistle blowing continuously.

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.

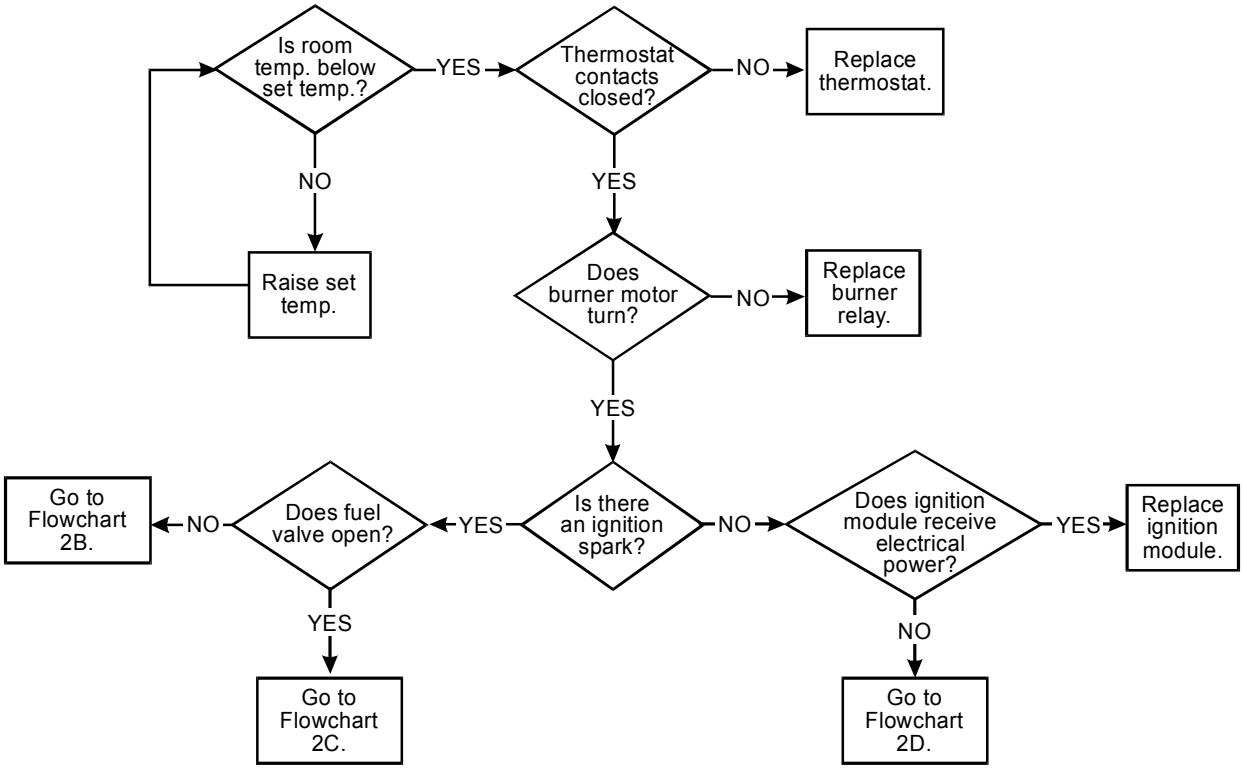
An answer key follows the sample items. The answer key lists the item number and correct answer for each sample test item. Please note that the answer key also lists the competency assessed by each item and that the sample items are not necessarily presented in competency order.

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

Competency 003

1. **Use the flowchart below to answer the question that follows.**

Flowchart 2A



A worker is using the above flowchart to troubleshoot a home heating system. The thermostat is set to a temperature of 68°F, and the room temperature is 65°F. The thermostat contacts are closed, but the burner motor fails to turn. The worker replaces the burner relay, and the burner motor immediately begins to turn. According to the flowchart, if the heating system still fails to function, the worker should next check the:

A. temperature setting.

B. ignition spark.

C. thermostat contacts.

D. fuel valve.

Competency 005

2. A local business has purchased a newer model of a piece of machinery and has offered to donate the older model to the secondary school's technology education program. Which of the following questions should be answered first in deciding whether to accept the gift?

   A. Is the donated machinery versatile enough to replace several of the program's current machines?

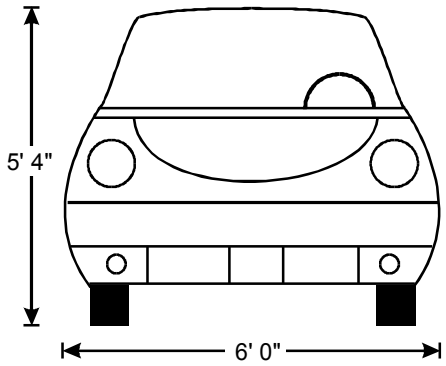
   B. Does the piece of machinery have applications in the school's technology education curriculum?

   C. Will there be sufficient space for the machinery in the current technology education laboratory?

   D. Will the program be better served by purchasing a newer model of the machinery?

Competency 006

3. **Use the diagram below to answer the question that follows.**



An engineer wants to make a 1:4 scale model of the car represented in the above diagram. What should the height of the scale model be?

A. 1' 3"

B. 1' 4"

C. 1' 6"

D. 1' 8"

Competency 007

4. A student is planning to use a computer graphics program to create a logo for the school chess club. One advantage of creating the logo using a vector-based program instead of a raster-based program is that only the vector-based graphic can be:

   A. optimized for publication on a Web site.

   B. reproduced on presses using a four-color scheme.

   C. reproduced in different sizes without loss of quality.

   D. converted to a portable document file format.

Competency 008

5. A student is using software and a computer to make a digital recording of a student playing an acoustic guitar. Increasing the sampling rate the software uses will increase:

   A. the sound quality of the guitar on the recording.

   B. the number of additional tracks that can be recorded.

   C. the input volume at which the music is captured.

   D. the amount of disk space available for other recordings.

Competency 009

6. What is the primary function of a satellite in a global communications system?

   A. to convert signals from analog to digital format

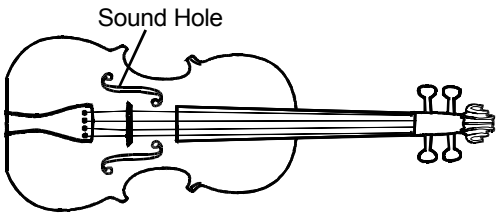
   B. to relay signals from one location to another

   C. to encode data for transmitting over long distances

   D. to receive and demodulate data for storage and retrieval

Competency 012

7. **Use the diagram below to answer the question that follows.**



Which of the following tools should be used to make the sound holes in the musical instrument shown above?

   A. skill saw

   B. miter saw

   C. band saw

   D. coping saw

Competency 014

8. Which of the following is an example of the manufacturing process of forming?

   A. An acetylene torch is used to cut the edges of a metal plate.

   B. A drop forge is used to manufacture a wrench.

   C. A lathe is used to taper a cylindrical metal shaft.

   D. An oven is used to temper a steel cutting blade.

Competency 016

9. The keystone in a stone arch bridge is subject primarily to which of the following types of forces?

   A. shear

   B. torsion

   C. compression

   D. tension

Competency 017

10. A construction worker would be most likely to use a transit to check if:

    A. the pitch of a roof conforms to the specifications of the blueprint.

    B. an interior wall is plumb.

    C. the tops of foundation walls are at the same height.

    D. a floor joist is level.

Competency 018

11. Cedar is often used as decking material in building patio decks. Which of the following characteristics of cedar wood makes it especially useful for this purpose?

    A. Cedar wood has a higher strength-to-weight ratio than many other types of woods.

    B. Cedar wood has many cross-grained fibers and is resistant to splitting when nailed.

    C. Cedar wood contains natural oils that make it more resistant to rot than many other types of wood.

    D. Cedar wood is especially hard and durable and holds up well to heavy foot traffic.

Competency 020

12. Students in a technology class have determined that an electric motor can lift a maximum weight of 4 N a vertical height of 1.5 m in 8 seconds. Which of the following quantities associated with the motor can be directly determined from this information?

    A. the power

    B. the efficiency

    C. the torque

    D. the impedance

Competency 021

13. Which of the following is the cleanest burning fossil fuel?

    A. bituminous coal

    B. kerosene

    C. natural gas

    D. gasoline

Competency 022

14. Engineers designing a pneumatic system would use an actuator to:

    A. control the flow of fluid in one direction only.

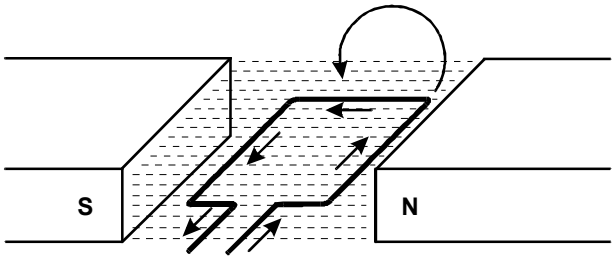
    B. control the pressure of the fluid in the system.

    C. move fluid from one part of the system to another.

    D. convert fluid power into mechanical power.

Competency 023

15. **Use the diagram below to answer the question that follows.**



A mechanical force is used to rotate a conducting wire loop between the poles of a magnet, causing a current to flow in the loop. This is an example of electromagnetic:

A. induction.

B. resonance.

C. radiation.

D. propagation.

Competency 025

16. Recent advances in biotechnology have led to the insertion of foreign-species genes into vegetables to increase their shelf lives. One concern raised by this procedure is that:

A. the procedure makes the vegetable more susceptible to food-borne pathogens.

B. consumers with allergies may become ill after eating the vegetable.

C. genes that have been inserted into one species may escape and become inserted into another species.

D. the procedure may reduce desirable and marketable characteristics of the vegetable.

Competency 026

17. Which of the following is an example of substituting a renewable for a non-renewable source of energy?

    A. switching from oil to natural gas to generate electricity

    B. using electricity rather than gasoline to power an automobile

    C. switching from coal to nuclear power for generating electricity

    D. mixing ethanol with gasoline to power an automobile

ANSWER KEY

Item Number	Correct Answer	Competency
1	**B**	003
2	**B**	005
3	**B**	006
4	**C**	007
5	**A**	008
6	**B**	009
7	**D**	012
8	**B**	014
9	**C**	016
10	**C**	017
11	**C**	018
12	**A**	020
13	**C**	021
14	**D**	022
15	**A**	023
16	**B**	025
17	**D**	026

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

Journal of Technology Education, Council on Technology Teacher Education and the International Technology Education Association.

Journal of Vocational Education Research, American Vocational Education Research Association.

Technology and Children, International Technology Education Association.

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Online Resources

International Technology Education Association. http://www.iteawww.org

Texas Education Agency Career and Technology Education. http://www.tea.state.tx.us/Cate/

00624-55072 • WEBPDF106