
**NEW YORK STATE TEACHER
CERTIFICATION EXAMINATIONS™**

**FIELD 77: TECHNOLOGY EDUCATION
TEST FRAMEWORK**

June 2003

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**New York State Teacher
Certification Examinations™**

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Fundamentals of Technology
Communication Systems
Power and Energy Systems
Manufacturing and Construction Systems
Transportation Systems
Bio-related Systems
Fundamentals of Technology: Constructed-Response Assignment

The New York State technology education teacher has the knowledge and skills necessary to teach effectively in New York State public schools. The technology education teacher has a broad understanding of the goals and procedures of technology education, understands technological systems, and can address challenges and analyze problems in the areas of communication, power and energy, manufacturing and construction, transportation, and bio-related technology. Finally, the technology education teacher understands the historical development of ideas in science and technology; the connections among mathematics, science, and technology; and the role of technology in the modern world.

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SUBAREA I—FUNDAMENTALS OF TECHNOLOGY

0001 Understand the use of engineering design in problem solving.

For example:

- recognizing the roles of modeling, optimization, prototypes, and performance testing in the design process
- applying procedures for setting and meeting technological design criteria
- identifying basic attributes of design and applying steps and procedures used in engineering design
- applying procedures for generating creative solutions to problems (e.g., breaking ideas into significant functional elements, brainstorming, predicting outcomes using mathematical and functional modeling techniques)
- using critical-thinking skills to generate and evaluate multiple solutions to a technological problem
- applying principles and procedures (e.g., sketching skills, drafting, CAD, interpreting technical drawings, dimensioning skills) used in technical drawing

0002 Understand the appropriate selection of tools and resources and understand the effects of technological procedures.

For example:

- evaluating a given technological situation to determine the appropriate resources to be used (e.g., tools, capital, time, energy, materials)
- using a variety of tools and machines to process materials, energy, and information
- identifying the properties and describing the characteristics of tools, equipment, and materials used in the various technological systems (i.e., communication, power and energy, manufacturing and construction, transportation, and bio-related)
- explaining why optimization of characteristics such as safety, cost, ease of operation, and environmental impact is sometimes necessary when selecting systems for specific purposes
- identifying and implementing safety procedures in the various technological systems (i.e., communication, power and energy, manufacturing and construction, transportation, and bio-related)

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0003 Understand the applications of computer technology.

For example:

- recognizing the role of computers in modeling, prototyping, and performance testing
- recognizing the role of computers as a tool in the various technological systems (i.e., communication, power and energy, manufacturing and construction, transportation, and bio-related)
- recognizing terminology related to computers and computer networks (e.g., platform, server)
- demonstrating knowledge of basic principles of computer architecture and computer programming
- applying procedures for selecting, operating, and maintaining computer hardware

0004 Understand how technological systems are designed to achieve specific results and produce outputs.

For example:

- recognizing applications of systems in the various technological areas (i.e., communication, power and energy, manufacturing and construction, transportation, and bio-related systems)
- demonstrating and applying knowledge of the systems approach to technology (e.g., input, process, output, feedback)
- analyzing relationships among complex technological systems (i.e., how technological systems operate individually and interdependently)
- examining how systems are influenced by a variety of input/output devices, processing units, and controllers (e.g., sensors and actuators)
- identifying and selecting appropriate technological systems to achieve specific results

0005 Understand the history and evolution of technology.

For example:

- demonstrating knowledge of the history of technology
- explaining how major advances, discoveries, and inventions in technology have resulted in changes in how people live and work
- analyzing factors (e.g., social, political, economic, environmental, ethical) that have influenced scientific discovery and technological innovation
- analyzing trends in technology for the purpose of predicting future technological advances

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0006 Understand the impacts of technology on individuals, society, and the environment.

For example:

- analyzing social, political, and economic factors that have encouraged and discouraged scientific discovery and technological innovation
- assessing the influence of scientific and technological innovations on productivity and living standards
- analyzing the interrelationships between technology and the environment (e.g., conservation, environmental monitoring, alignment of natural and technological processes)
- recognizing the role of society in the development and use of technology
- explaining how technological innovations stimulate competitiveness and examining how innovations are translated into marketable goods and services

0007 Understand management techniques in technology.

For example:

- applying procedures for developing work schedules and plans that make optimal use of materials, processes, time, and expertise
- applying procedures for documenting and communicating processes using computer-based scheduling and project tracking tools such as flowcharts and graphs
- explaining the role of evaluation and quality control in technological systems
- identifying and describing capital and human resources related to various technological systems (e.g., types and sources of working capital, work roles and organizational structures)

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0008 Understand the connections among science, mathematics, and technology.

For example:

- recognizing the core concepts of technology (e.g., systems, resources, requirements, optimization, processes, controls) and their connections with mathematics and science
- identifying and using basic principles of mathematics, physics, chemistry, biology, and electronics (e.g., quadratic equations, graphing, trigonometric functions, dimensional analysis, force, laws of thermodynamics, Ohm's law) to solve technological problems
- demonstrating knowledge of the significance of major advances, discoveries, and inventions in mathematics, science, and technology
- using mathematical, scientific, and functional modeling techniques for generating solutions to problems
- analyzing the roles of troubleshooting, research and development, invention and innovation, and experimentation in problem solving

SUBAREA II—COMMUNICATION SYSTEMS

0009 Understand principles and characteristics of communication technology.

For example:

- identifying career areas, employment opportunities, and job specialties in communication technology
- identifying elements of graphic design (e.g., line, color, proportion, typography, layout) and examining their role in communication
- demonstrating an understanding of principles, procedures, and production processes related to graphic arts, electronic publishing, and the broadcast industry (e.g., scaling, photo imaging, image resolution, image assembly, image carrier, image transfer)
- recognizing principles of design and composition in photography and identifying characteristics and uses of various printing processes (e.g., film development and printing; electrostatic, screen, relief, and offset printing; digital photography)
- identifying properties and describing characteristics of tools, materials, and equipment used in graphic, electronic, and visual communication

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0010 Understand the processes and procedures of communication technology industries.

For example:

- applying procedures used in design, technical drawing, graphics, and reproduction
- demonstrating knowledge of procedures used in electronic communications (e.g., conversions between analog and digital signals, use of communication software, principles of satellite communication)
- analyzing procedures for interfacing communication equipment related to broadcast and multimedia presentations (i.e., using sound, video, and text)
- identifying and implementing safety procedures in the various areas of communication technology (e.g., chemical, mechanical, electrical, optical)

0011 Understand the appropriate selection and use of resources in communication technology.

For example:

- identifying components used in communication technology (e.g., modems, mixers, satellites, communication software, photonics)
- evaluating a given communication situation to determine the appropriate applications of tools, equipment, and materials
- applying technical processes used in design, drafting, photography, and printing
- selecting appropriate tools, equipment, and materials for a variety of communications applications
- identifying appropriate media to effectively communicate a desired message

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SUBAREA III—POWER AND ENERGY SYSTEMS

0012 Understand principles and characteristics of power and energy technology.

For example:

- identifying career areas, employment opportunities, and job specialties in power and energy technology
- identifying renewable and nonrenewable energy resources and describing their applications, limitations, and future impacts
- demonstrating knowledge of technical processes related to the various forms of energy (e.g., chemical, electrical, nuclear, radiant)
- recognizing principles and processes related to energy conversions according to their respective laws of physics
- applying scientific principles to solve problems involving the harnessing, transfer, loss, and conservation of power and energy
- applying scientific principles to solve problems involving the transmission of power and energy

0013 Understand the processes and procedures of power and energy technology.

For example:

- identifying the specific properties and describing the characteristics of tools, equipment, and materials used in power and energy technology
- calculating units of power and energy
- analyzing a variety of electrical circuits, including digital electronic circuits, and solving problems involving current, voltage, resistance, and power in an electrical circuit
- identifying and implementing safety procedures in the various areas of power and energy technology (e.g., electrical, mechanical, chemical)

0014 Understand the appropriate selection and use of resources in power and energy technology industries.

For example:

- analyzing trends in power and energy technology, such as conservation and energy sources, to optimize the selection of resources
- recognizing applications of power and energy technology in manufacturing, construction, transportation, and communication
- measuring, recording, and analyzing power and energy in a variety of applications

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SUBAREA IV—MANUFACTURING AND CONSTRUCTION SYSTEMS

0015 Understand principles and characteristics of manufacturing and construction technology.

For example:

- identifying career areas, employment opportunities, and job specialties in manufacturing and construction technology
- identifying types of manufacturing systems (e.g., just-in-time, continuous, custom, automated) and analyzing their characteristics
- demonstrating knowledge of legal and ethical issues related to manufacturing and construction (e.g., building codes, environmental regulations, labeling requirements, warranties)
- describing the characteristics of tools, materials, and equipment used in manufacturing and construction
- identifying types of manufacturing and construction industries and describing their characteristics

0016 Understand the processes and procedures of manufacturing and construction technology.

For example:

- analyzing building designs and requirements (e.g., location, cost, use, size, zoning)
- explaining processes and procedures used to construct various types of structures (e.g., buildings, bridges, playgrounds) and recognizing steps involved in project planning
- explaining technical processes related to manufacturing and construction (e.g., separating, forming, combining, conditioning)
- identifying and implementing safety procedures in the various areas of manufacturing and construction technology (e.g., mechanical, electrical, chemical, optical)

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0017 Understand the appropriate selection and use of resources in manufacturing and construction technology.

For example:

- analyzing trends in manufacturing and construction technology (e.g., robotics, engineered materials) to optimize the selection of resources
- recognizing applications of manufacturing and technology in communication, energy utilization, construction, and transportation
- evaluating a given construction situation to determine appropriate construction method (e.g., site-built, manufactured)
- selecting appropriate materials based upon their properties and characteristics (e.g., strength, weight, availability, cost, environmental impact)
- demonstrating the appropriate use of specific tools and equipment in manufacturing and construction processes (e.g., cutting, joining, finishing)

SUBAREA V—TRANSPORTATION SYSTEMS

0018 Understand principles and characteristics of transportation technology.

For example:

- identifying career areas, employment opportunities, and job specialties in transportation technology
- identifying and classifying types of transportation systems (e.g., land, air, marine, space, intermodal)
- identifying types of transportation industries and describing their characteristics
- recognizing and describing power sources and systems used in transportation
- identifying and analyzing technological problems that exist in transportation systems

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0019 Understand the processes and procedures of transportation technology.

For example:

- identifying and describing the characteristics of tools, equipment, and materials used in transportation technologies
- demonstrating knowledge of technical processes related to land, air, marine, and space transportation systems (e.g., energy storage, propulsion, guidance, control)
- applying the appropriate scientific principles (e.g., buoyancy, thrust, lift, inertia, momentum, gravitational acceleration) to solve problems in transportation
- identifying and implementing safety procedures in the various areas of transportation technology (e.g., chemical, mechanical, electrical)

0020 Understand the appropriate selection and use of resources in transportation technology industries.

For example:

- analyzing trends in transportation technology (e.g., advances in space flight, increased use of electrical vehicles, utilization of global positioning systems, air bag safety) to optimize selection of resources
- recognizing applications of transportation technology in communication, energy utilization, and production
- selecting appropriate tools and equipment (e.g., hydraulic, pneumatic, electric) and materials for a variety of transportation applications
- evaluating a given transportation situation to determine appropriate uses of tools, equipment, and materials (e.g., servicing transportation vehicles; materials handling; interpreting avionics gauges, dials, and readouts; setting up an exhaust analyzer to give accurate readings)

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SUBAREA VI—BIO-RELATED SYSTEMS

0021 Understand principles and characteristics of bio-related technology.

For example:

- identifying career areas, employment opportunities, and job specialties in bio-related technology
- identifying and describing types of biotechnological systems (e.g., bio-processing, agriculture, hydroponics, aquaculture)
- applying scientific principles associated with bio-related systems (e.g., electronics in pacemakers, osmosis in dialysis, lasers in surgery)
- identifying the properties and characteristics of tools, equipment, and materials used in bio-related technology
- recognizing applications of DNA mapping

0022 Understand the processes and procedures of bio-related technology.

For example:

- using microorganisms in food production (e.g., enzymes, yeast)
- identifying bio-processing methods used in environmental applications (e.g., oil spill clean-up, reclamation, desalinization, hydroponics)
- demonstrating a knowledge of bio-generated alternative fuels (e.g., ethanol, methane, wood pellets)
- identifying and implementing safety procedures in the various areas of bio-related technology (e.g., chemical, mechanical, electrical, biological)

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0023 Understand the appropriate selection and use of resources in bio-related technology industries.

For example:

- identifying trends in biomedical materials and equipment (e.g., prosthetic limbs, joint replacements, implantable devices, artificial organs) to optimize selection of resources
- selecting and using appropriate tools, equipment, and materials in bio-related technology applications
- identifying biodegradable materials to replace nonrenewable resources
- identifying the appropriate resources for monitoring health functions (e.g., heart rate monitor, digital thermometer, blood pressure monitor)
- designing adaptive devices (e.g., mobility, optical, ADA compliance) to assist individuals with physically disabling conditions
- identifying devices that maximize safety and quality of life (e.g., orthotics, air bags, lumbar supports, wrist supports)

SUBAREA VII—FUNDAMENTALS OF TECHNOLOGY: CONSTRUCTED-RESPONSE ASSIGNMENT

The content to be addressed by the constructed-response assignment is described in Subarea I, Objectives 01–08.