NOCTI®

Pennsylvania Customized Assessment Blueprint

Engineering Technologies/Technicians PA

Test Code: 8091 / Version 1

General Assessment Information

Blueprint Contents

Test Type: The Engineering Technologies/Technicians PA assessment was developed based on a Pennsylvania statewide competency task list and contains a multiple-choice and performance component. This assessment is meant to measure technical skills at the occupational level and includes items which gauge factual and theoretical knowledge.

Revision Team: The assessment content is based on input from Pennsylvania educators who teach in approved career and technical education programs.

CIP Code

15.9999 - Engineering Technologies/Technicians, Other

Learning that works for America CTE™

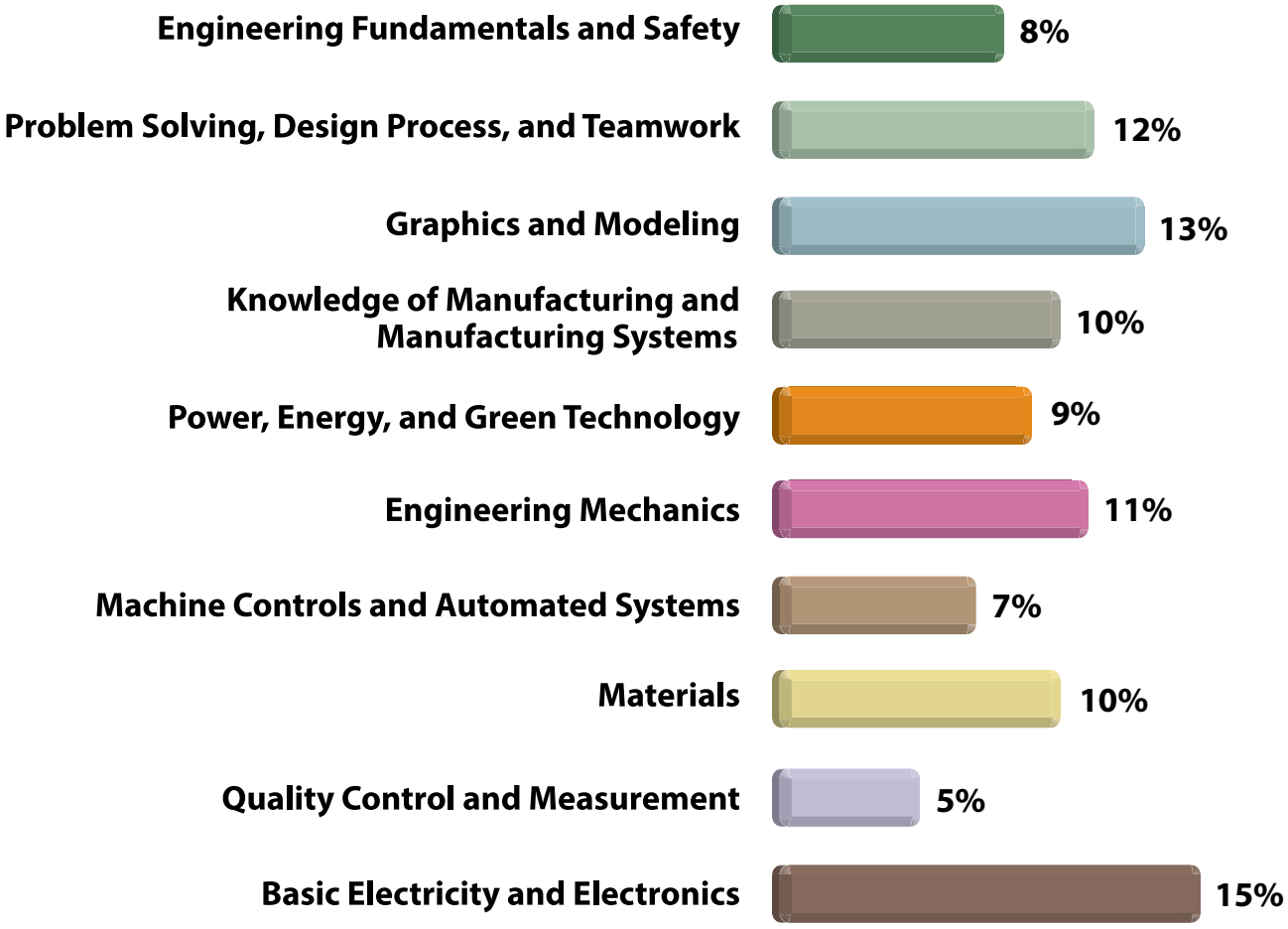
12 - Science, Technology, Engineering & Mathematics

Written Assessment

NOCTI written assessments consist of questions to measure an individual's factual theoretical knowledge.

Administration Time: 3 hours
Number of Questions: 200
Number of Sessions: This assessment may be administered in one, two, or three sessions.

Areas Covered



Specific Standards and Competencies Included in this Assessment

Engineering Fundamentals and Safety

- Implement a safety plan
- Operate lab equipment according to safety guidelines
- Use appropriate personal protective equipment
- Comply with OSHA and EPA regulations for a safe work site
- Identify emergency first aid procedures
- Maintain safe working practices around tools and equipment
- Participate in classroom and laboratory management and clean-up activities
- Investigate engineering careers, training and associated opportunities
- Explain the purpose and functions of an engineering team
- Analyze current Professional Engineering codes of ethics
- Analyze ethical engineering issues
- Analyze and explain ethical and technical issues contributing to an engineering disaster

Problem Solving, Design Process, and Teamwork

- Identify the engineering problem
- Gather information about problems and solutions
- Apply steps in the problem-solving method
- Identify the way numbers are expressed in scientific notation, engineering notation, and System International (SI) notation
- Actively participate as a member of an engineering project team
- Apply constructive feedback
- Resolve conflict within the team
- Demonstrate active listening techniques
- Demonstrate formal and informal speaking skills
- Explain the importance of selling a project idea to team members
- Identify the steps of an iterative design process
- Determine whether design is safe for a given user
- Generate a design improvement to address specific flaws/failures
- Create a proposal for an engineering project
- Participate in a design review

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Specific Standards and Competencies (continued)

Graphics and Modeling

- Proper use of graphics equipment and tools
- Describe various types of drawings
- Perform metric-U.S. system conversions
- Use engineer's and architect's scales
- Prepare freehand sketches
- Apply line conventions
- Prepare additional views to clarify the design
- Apply principles of dimensioning and annotation
- Prepare drawings for product assembly, fabrication, or construction
- Create schematics
- Identify the three areas of modeling (i.e., physical, conceptual, and mathematical)
- Create a scale model or working prototype
- Identify methods and sources for obtaining materials and supplies
- Compile a materials list that includes vendors and costs for all required materials and equipment to build the prototype
- Write a step-by-step procedure for an assembly

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Specific Standards and Competencies (continued)

Knowledge of Manufacturing and Manufacturing Systems

- Research the history of manufacturing and its milestones
- Research a topic in manufacturing
- Describe procedures used in manufacturing
- Identify basic flowcharting and discuss their functions
- Create and apply a flowchart that portrays a manufacturing process
- Create a control system that replicates a factory cell
- Demonstrate how research is used in Engineering Economics
- Demonstrate the relationship of time and cost to manufacturing systems
- Explain the difference between primary and secondary manufacturing processes
- Evaluate and present a production line activity
- Outline the product-development process
- Plan steps of production for a manufactured product
- List tools needed for a manufactured product
- Make a list of the production processes in manufacturing
- Apply manufacturing systems to develop and produce a prototype for a product
- Evaluate a product prototype and the processes used in its manufacture
- Prepare a process, identify machines that will be used to carry out the process, then describe the work that each machine performs
- Research the history and industrial use of CAM

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Specific Standards and Competencies (continued)

Power, Energy, and Green Technology

- Define "What is Power"
- Discuss the forms of potential energy
- Discuss the forms of kinetic energy
- Research methods of energy conversion (e.g., electrical, fluid, mechanical)
- Define terms used in power systems
- Name the Laws of Thermodynamics
- Research renewable/non-renewable energy sources
- Study energy efficiency and conservation
- Calculate material properties relating to a stress strain curve
- Create a model that will utilize a renewable energy concept
- Create a written report of material test evaluations
- Prepare a concept of an alternative energy for transportation

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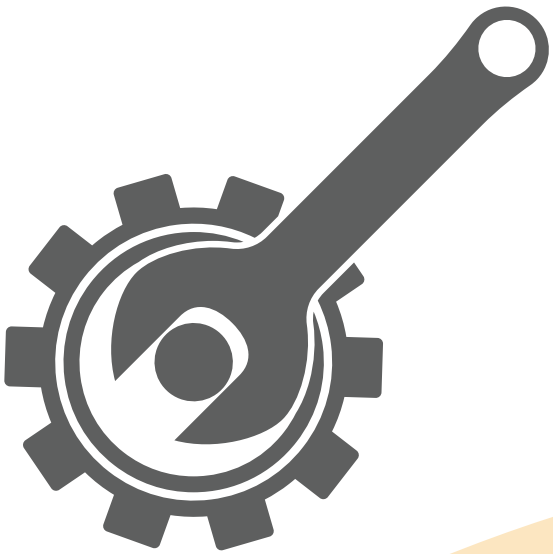
Specific Standards and Competencies (continued)

Engineering Mechanics

- Locate and explain examples of the six simple machines, their attributes, and components
- Measure forces and distances related to mechanisms
- Calculate mechanical advantage and drive ratios of mechanisms
- Design, create, and test various drive systems
- Determine efficiency in a mechanical system
- Convert power between units
- Measure torque, and use it to calculate power
- Demonstrate principles of mechanical systems as they relate to power transmission
- Identify components of a fluid system
- Calculate values in a fluid power system, using Pascal's Law
- Calculate values in a pneumatic system, using the ideal gas laws
- Calculate flow rate, flow velocity, and mechanical advantage in a fluid power system
- Given a set of data, calculate distance, displacement, speed, velocity, and acceleration
- Calculate acceleration due to gravity, based on data from a free-fall device
- Design a vehicle that stores and releases potential energy for propulsion



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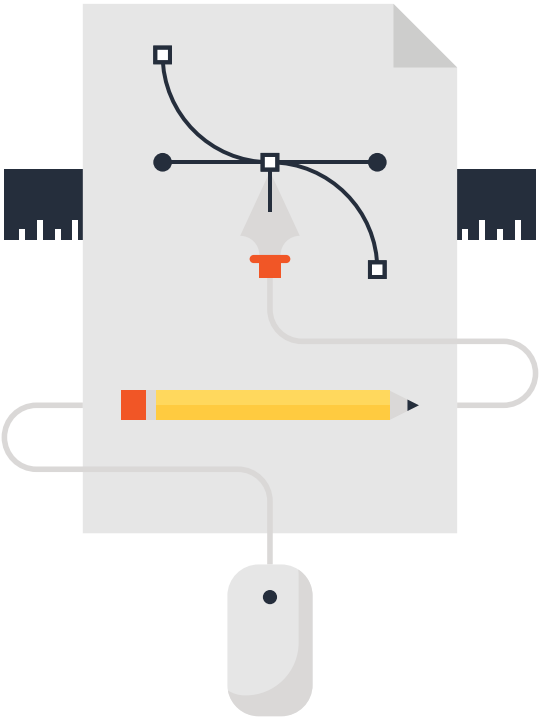
Specific Standards and Competencies (continued)

Machine Controls and Automated Systems

- Choose appropriate machine control inputs and outputs, based on the need of a technological system
- Differentiate between the characteristics of digital and analog devices
- Select between open and closed loop systems to solve a technological problem
- Create system control programs that use flowchart logic
- Define and discuss open and closed loop systems
- Create and use flowcharts
- Identify components needed to integrate computer controls for an automated system
- Plan, design, and construct an automated system
- Program an automated system using computer hardware and software
- Interface output devices to a computer, microcontroller, or programmable logic controller



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Specific Standards and Competencies (continued)

Materials

- Describe the properties of materials
- Investigate methods used to alter materials
- Illustrate causes of failure in materials
- Investigate various types of metals and application
- Investigate various types of natural and manufacturing wood and applications
- Investigate various types of ceramics and applications
- Investigate various composite and synthetic materials
- Demonstrate knowledge of the principles of statics and dynamics to calculate the strength of various engineering materials used to build a structure
- Create free body diagrams of objects, identifying all forces acting on the object
- Differentiate between scalar and vector quantities
- Identify magnitude, direction, and sense of a vector
- Calculate the X and Y components, given a vector
- Calculate moment forces, given a specified axis

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Specific Standards and Competencies (continued)

Quality Control and Measurement

- Apply Total Quality Management techniques (TQM)
- Demonstrate knowledge of ISO-quality standards
- Make linear measurements accurately to 1/16-inch
- Use a micrometer to measure accurately to .001-inch
- Use a dial caliper to measure accurately to .001-inch
- Use combination squares and protractors for angular measurement

Basic Electricity and Electronics

- Identify and demonstrate safety rules and use of electricity lab machines and equipment
- Define and describe basic electrical terms
- Determine the direction of current flow in DC circuits
- Determine the direction of current flow in AC circuits
- Identify and draw electronic symbols and circuit diagrams
- Identify resistors by type and value
- Describe types of sensing and control devices
- Determine current, voltage, and resistance in series-parallel circuits
- Measure circuit values with a multi-meter
- Compute values of current, resistance, and voltage using Ohm's Law
- Compute the values of electrical power
- Calculate voltage, amperage, and resistance in series circuits
- Calculate voltage, amperage, and resistance in parallel circuits
- Use a variety of meters to take readings
- Demonstrate lock-out/tag-out procedures
- Identify purpose and location of over-current devices
- Select over-current devices
- Explain transformer operation

Sample Questions

It is important to conduct research and gather information

A. only when the problem requires it
B. after a solution has been tested
C. instead of identifying the problem
D. when using the problem solving process

A/An _____ model requires a destructive prototype test.

A. physical
B. conceptual
C. mathematical
D. manufacturing

What is the primary function of insulation?

A. to maintain temperature
B. to keep the pipe or vessel from rusting
C. to prevent infestation
D. to maintain sanitary conditions

The main factor in selecting a closed loop system over an open loop system is

A. cost saving to the engineer for design work
B. the need to change variables depending on feedback
C. materials needed for manufacture of the part
D. increased safety and speed of outcomes

A _____ measures length to an accuracy of 0.001 inch.

A. ruler
B. scale
C. micrometer
D. millimeter

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Sample Questions (continued)

Wear approved safety glasses whenever working with machinery because

A. they improve vision
B. they are tested and rated for protection
C. the manager said so
D. they reduce glare

The event that started the Industrial Revolution was

A. the organization of the U.S. Postal Service
B. the distribution of government funding
C. the invention of the steam engine
D. the development of the microprocessor

The screw is an example of the application of which other simple machine?

A. lever
B. inclined plane
C. wheel and axle
D. pulley

Nonferrous metals have an absence of

A. copper
B. aluminum
C. brass
D. iron

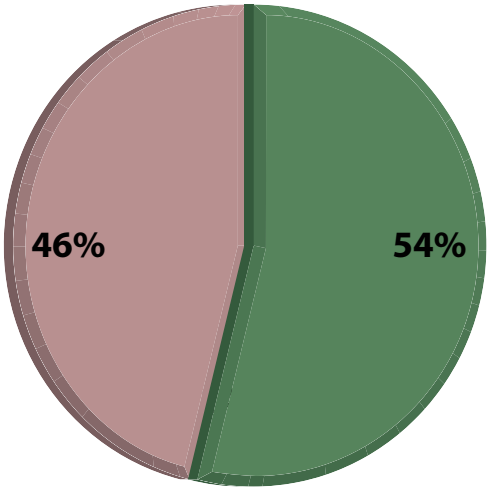
When dealing with electricity, one should avoid

A. wet or damp surfaces
B. an electrostatic discharge bracelet
C. using an oscilloscope
D. using high wattage resistors

Performance Assessment

NOCTI performance assessments allow individuals to demonstrate their acquired skills by completing actual jobs using the tools, materials, machines, and equipment related to the technical area.

Administration Time: 3 hours
Number of Jobs: 2



Areas Covered:

54% Part Creation and Modification
Participant will create a 3-D solid model using the diagram provided, print the drawing including necessary dimensions and save the completed job.

46% Paper Tower
Participant will use engineering design process to design and build the tallest tower possible using only the supplied tape and colored paper.

Sample Job

Paper Tower

Maximum Time: 1hour and 15 minutes

Participant Activity: The participant will use engineering design process to design and build the tallest tower possible using only the supplied tape and colored paper.