

# Electronics

## Study Guide

### Assessments:

**4001 General Electronics Technician**

**4002 Electronics Assembler**

Aligned with the  
National Skills Standards  
Board (NSSB)

Endorsed by:



## Overview

This study guide is designed to help students prepare for the following Electronics assessments: General Electronics Technician, and Electronics Assembler. It not only includes information about the assessments, but also the skills standards upon which the assessments are based and test taking strategies. The assessments measure a student's ability to apply knowledge of the skills necessary for success in the Electronics field.

Each of the four sections in this guide provides useful information for students preparing for the General Electronics Technician, Electronics Assembler, and Biomedical Electronics Technician assessments.

- CareerTech and Competency-Based Education: A Winning Combination
- Electronics Assessments
  - ▶ Assessment Information
  - ▶ Standards and Test Content
  - ▶ Sample Questions
  - ▶ Abbreviations, Symbols, and Acronyms
- Strategies for Test Taking Success
- Notes

The General Electronics Technician assessment and Electronics Assembler assessment are aligned with the National Skills Standards Board (NSSB) and endorsed by Cameron Measurement Systems. The Biomedical Electronics Technician assessment is aligned with the NSSB. The NSSB, established in 1994, has built a voluntary system of skill standards, assessment, and certification systems to enhance the ability of individuals to compete effectively in the global economy. Cameron's business legacies predate the beginning of the world's oil and gas industry, being a leading provider of flow equipment products, systems and services to worldwide oil, gas and process industries.

NSSB: [www.gskillsxchange.com/](http://www.gskillsxchange.com/)

Cameron Measurement Systems: [www.c-a-m.com](http://www.c-a-m.com)

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# CareerTech and Competency-Based Education: A Winning Combination

Competency-based education uses learning outcomes that emphasize both the application and creation of knowledge and the mastery of skills critical for success. In a competency-based education system, students advance upon mastery of competencies, which are measurable, transferable outcomes that empower students.

Career and technology education uses industry professionals and certification standards to identify the knowledge and skills needed to master an occupation. This input provides the foundation for development of curriculum, assessments and other instructional materials needed to prepare students for wealth-generating occupations and produce comprehensively trained, highly skilled employees demanded by the work force.

## Tools for Success

CareerTech education relies on three basic instructional components to deliver competency-based instruction: skills standards, curriculum materials, and competency assessments.

**Skills standards** provide the foundation for competency-based instruction and outline the knowledge and skills that must be mastered in order to perform related jobs within an industry. Skills standards are aligned with national skills standards and/or industry certification requirements; therefore, a student trained to the skills standards is equally employable in local, state and national job markets.

**Curriculum materials and textbooks** contain information and activities that teach students the knowledge and skills outlined in the skills standards. In addition to complementing classroom instruction, curriculum resources include supplemental activities that enhance learning by providing opportunities to apply knowledge and demonstrate skills.

**Competency Assessments** test the student over material outlined in the skills standards and taught using the curriculum materials and textbooks. When used with classroom performance evaluations, written competency assessments provide a means of measuring occupational readiness.

Each of these components satisfies a unique purpose in competency-based education and reinforces the knowledge and skills students need to gain employment and succeed on the job.

## Measuring Success

Evaluation is an important component of competency-based education. Pre-training assessments measure the student's existing knowledge prior to receiving instruction and ensure the student's training builds upon this knowledge base. Formative assessments administered throughout the training process provide a means of continuously monitoring the student's progress towards mastery.

Written competency assessments provide a means of evaluating the student's mastery of knowledge and skills. Coaching reports communicate competency assessment scores to students and provide a breakdown of assessment results by standard area. The coaching report also shows how well the student has mastered skills needed to perform major job functions and identifies areas of job responsibility that may require additional instruction and/or training.

# Electronics Assessments Information

## What are the Electronics assessments?

The General Electronics Technician, and Electronics Assembler assessments are end-of-program assessments for students in Electronics programs. The assessments provide an indication of student mastery of knowledge and skills necessary for success in careers in this area.

## How were the assessments developed?

The assessments were developed by the CareerTech Testing Center. The General Electronics Technician assessment and Electronics Assembler assessment are aligned with the National Skills Standards Board (NSSB) and endorsed by Cameron Measurement Systems. The Biomedical Electronics Technician assessment is aligned with the National Skills Standards Board. Items were developed and reviewed by a committee of subject matter experts.

## What do the assessments cover?

Specifically, the tests includes multiple-choice test items over the following areas:

### General Electronics Technician (60 questions)

Demonstrate Proper Procedures and Practices for Safety in the Work Area	3%
Demonstrate Employability Skills	3%
Identify and Demonstrate Proper Use of Industry-Specific Tools and Test Equipment	2%
Identify and Demonstrate Proper Use of Common Tools and Test Equipment	12%
Identify Components, Establish Their Value or Parameters using Common Reference Material and Color Codes, and Test for Proper Function	20%
Demonstrate Proper Soldering and Desoldering Procedures	2%
Read and Interpret Schematics, Diagrams, and Blueprints	5%
Interpret and Apply Industry-Specific Codes and Regulations	2%
Evaluate Direct Current Circuits	11%
Evaluate Alternating Current Circuits	10%
Evaluate Common Semi-Conductor Devices	5%
Evaluate Analog Circuit Devices	11%
Evaluate Digital Logic Devices	7%
Evaluate Microprocessor Systems	2%
Evaluate Communications Techniques and Equipment	2%
Generate Technical Documentation	3%

### Electronics Assembler (55 questions)

Demonstrate Proper Procedures and Practices for Safety in the Work Area	25%
Demonstrate Employability Skills	7%
Identify and Demonstrate Proper Use of Industry-Specific Tools and Test Equipment	5%
Identify and Demonstrate Proper Use of Common Tools and Test Equipment	23%
Identify Components, Establish Their Value or Parameters Using Common Reference Material and Color Codes, and Test for Proper Function	25%

Demonstrate Proper Soldering and Desoldering Procedures	5%
Identify Fasteners and Terminals and Demonstrate Proper Installation Procedures	5%
Read and Interpret Schematics, Diagrams, and Blueprints	5%

## **What are the benefits of using these assessments?**

Students receive a competency certificate for each assessment that he/she passes. This certificate may be included in his/her portfolio and used to communicate the student's mastery of the subject matter to potential employers.

## **When should the assessment be taken?**

The CareerTech Testing Center recommends that students take this assessment as soon as possible after receiving all standards-related instruction, rather than waiting until the end of the school year.

## **Is the assessment timed?**


No. However, most students finish the assessment within one hour.

## **What resources can students use on these assessments?**

Students are allowed to use calculators and scratch paper on CTTC competency assessments; however, these items must be provided by the testing proctor and returned to the proctor before the student's exam is submitted for scoring. Calculator apps on cell phones and other devices may not be used on these assessments.

## **What accommodations can be made for students with Individualized Education Plans (IEPs)?**

Accommodations are allowed for students with an Individualized Education Plan. Examples of allowable accommodations include:

- Extended time — This assessment is not timed; therefore, students may take as much time as needed to finish. The assessment must be completed in one testing session.
- Readers — A reader may be used to read the assessment to a student who has been identified as needing this accommodation.
- Enlarged text — Students needing this accommodation can activate this feature by clicking the  icon in the upper right corner of the screen.

## What can students expect on Test Day?

All CTTC assessments are web-based and delivered exclusively by a proctor in the school's assessment center. The proctor **cannot** be an instructor or anyone who was involved with the student during instruction.

Assessments are delivered in a question-by-question format. When a question is presented, the student can select a response or leave the question unanswered and advance to the next question. Students may also flag questions to revisit before the test is scored. All questions must be answered before the test can be submitted for scoring.

After the assessment is scored, the student will receive a score report that not only shows the student's score on the assessment, but also how the student performed in each standard area.

## Can students retake the test?

Students may retake the test unless their school or state testing policies prohibit retesting. Students who can retest must wait at least three days between test attempts.



# Standards and Test Content

## General Electronics Technician

### Demonstrate Proper Procedures and Practices for Safety in the Work Area (2 questions)

1. Identify and practice mechanical safety
  - Tool safety
  - Hand safety
  - Eye safety
2. Immediately report injuries/accidents following company procedures
3. Identify and practice electrical safety
4. Participate in “Right to Know” training and practice environmental safety
  - Chemical awareness
  - Environmental regulations
  - Gases and pressure safety
5. Identify and practice safety related to infectious disease, universal precautions, blood-borne pathogens, and chemical hygiene
6. Identify and practice thermal safety
7. Identify and practice radiation safety
8. Demonstrate and practice traffic and vehicle safety
9. Identify and practice laser safety
10. Demonstrate knowledge of lock-out/tag-out requirements and danger associated with potential energy sources
11. Identify and practice fiber optic handling safety
12. Perform a leakage check on electronic equipment
13. Test electrical equipment to ensure proper grounding
14. Identify sources of hazardous noise



### Demonstrate Employability Skills (2 questions)

1. Maintain a courteous and responsible attitude toward all customers
2. Demonstrate appropriate interpersonal skills
3. Maintain self-esteem in self and others
  - Analyze personal space and needs
  - Interpret emotional reactions
  - Determine values scale and attitudes
  - Cope with change
  - Interpret sensory clues

4. Recognize the importance of teamwork and participate as a team member

- Participate in team (group) meetings
  - Focus on topic and purpose of the meeting
  - Offer facts and ideas
  - Help others contribute facts and ideas
- Pass on good ideas
- Look for ways to help others
- Give recognition for things well done
- Let others know what you need to get the job done



5. Maintain professional respect for supervisor and co-workers

6. Use professionalism

- Follow facility dress code
- Exhibit positive attitude
- Exhibit initiative
- Exhibit loyalty
- Exhibit respect to others
- Exhibit flexibility
- Exhibit commitment
- Practice hygiene

7. Use critical thinking skills in workplace situations

- Distinguish appropriateness of equipment and tests
- Decision making
- Creativity
- Use quality performance processes
- Use tools to analyze information
  - Use basic statistical concepts and analysis
  - Create charts
  - Create histograms
  - Create flow charts
- Use quality tools
- Evaluate stressful situations
- Evaluate how to manage ethical conflicts

8. Maintain satisfactory attendance

- Punctuality
- Tardiness
- Early departure
- Absence
- Calling in

9. Use stress management techniques

10. Function within the organizational structure

- Chain of command
- Amount of empowerment

11. Distinguish the departments within the organization

12. Distinguish the roles of the organizational members

13. Use self-management and time management techniques

- Independence
- Self-evaluation
- Leadership skills
- Supervision
- Delegation
- Organization
- Prioritization
- Initiative

14. Use deductive and inductive reasoning skills



15. Use proper telephone etiquette

- Project positive telephone image
- Manage incoming telephone calls
  - Receive incoming calls
  - Screen incoming calls
  - Transfer incoming calls when indicated
  - Manage multiple incoming calls
  - Use telephone log or computerized system
- Manage telephone calls
  - Inquiries
- Manage telephone calls involving special problems
  - Unidentified callers
  - Angry callers
  - Calls from family and friends
- Manage telephone calls involving medical emergencies
- Record and deliver telephone calls
  - Local
  - Long distance
  - Conference
- Use special features if available
- Identify factors that relate to a global business environment
  - Time zones
  - International dialing codes
- Use telephone directories
  - Evaluate types and organization of each type
  - Use telephone assistance and information
  - Maintain company directory



16. Employ listening skills

- Show interest
- Ask questions and clarify what has been heard
- Let person know what you understand

17. Compose written communication legibly using correct grammar, spelling, and format

- Compose questions
- Compose consent forms
- Compose student evaluation reports
- Select and use appropriate format for written communication
- Use reference materials as appropriate
- Use proper grammatical techniques
  - Abbreviate for words used in addresses, measurements, months and days of the year
  - Use proper punctuation

18. Interpret and follow written directions and information

19. Interpret and follow oral directions

20. Use job-related terminology, symbols, and abbreviations

21. Use basic keyboarding skills and computer skills
  - E-mail
  - File transfer protocol (FTP)
  - Internet
  - Operating System
  - Office Suite Products
22. Use effective communication techniques with peers, co-workers, and customers
  - Pronounce words correctly
23. Use verbal and non-verbal communication techniques
24. Apply behavioral management techniques to workplace situations
  - Use personal coping skills
  - Deal with customers and co-worker attitudes
  - Exhibit a sense of humor
  - Use positive feedback techniques
    - Emphasize strengths
  - Use negative feedback techniques
    - Stress main points the person could do differently
25. Identify personal and work-related goals and monitor progress
  - Chart and set long, medium, and short term goals
  - Determine educational needs
  - Set professional goals
  - Set personal goals
26. Respond to compliments, complaints, conflicts, and criticism appropriately
27. Compile research data
28. Apply electronics-related mathematical concepts
  - Addition, subtraction, multiplication, and division of:
    - Whole numbers
    - Fractions
    - Decimals
    - Percentages
    - Binary mathematics
    - Hexadecimal mathematics
  - Exponents
  - Scientific notations
  - Significant digits
  - Basic trigonometry functions
  - Measurements
    - U.S. to metric
    - Metric to U.S.
  - Use of calculator
  - Concept of coins and currency
  - Estimation
  - Reading charts, graphs, and tables
  - Basic geometry
  - Application of formulas
    - Word problems
    - Thought problems



29. Use negotiation skills
  - Interpret how to reasonably disagree
  - Interpret ways to overcome objections
  - Solve everyday human relation problems
  
30. Use career development skills
  - Write cover/application letter
  - Complete job application
  - Interpret Form W-2
  - Write a job description
  - Investigate an occupation
  - Explore career opportunities
  - Compare career options
  - Develop a personal career plan
  - Negotiate salary and benefits
  
31. Use multi-cultural sensitivity skills
  - Recognize and respect diverse customs and accommodate them in the work environment
  
32. Understand anti-discriminatory laws and take steps to comply with laws relating to:
  - Gender
  - Race
  - Disability
  - Age
  - Religion
  - National origin
  - Color

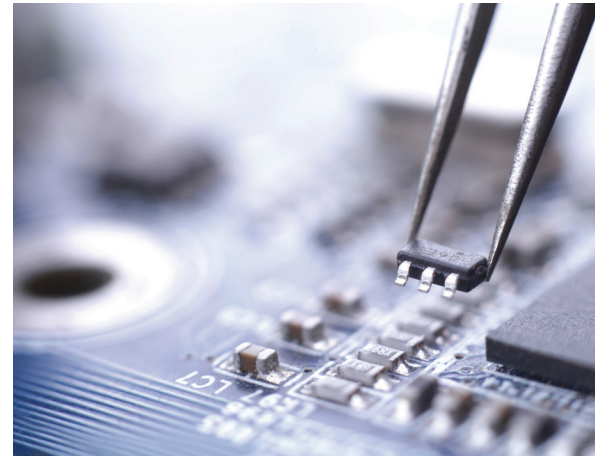
## **Identify and Demonstrate Proper Use of Industry-Specific Tools and Test Equipment (1 question)**

1. Demonstrate proper use of occupationally-specific tools
2. Identify automated testing equipment and methods of using test circuits and systems
3. Use appropriate instrumentation to test ESD protective systems

## **Identify and Demonstrate Proper Use of Common Tools and Test Equipment (7 questions)**

1. Use an analog multimeter to measure:
  - Voltage
  - Current
  - Resistance
  
2. Use a digital multimeter to measure:
  - Voltage
  - Current
  - Resistance
  
3. Use an oscilloscope to measure AC, DC, and time-based waveforms
4. Use a function/signal generator to simulate necessary signals
5. Use frequency counters to measure frequencies and period
6. Use a digital storage oscilloscope to capture and display specialized waveforms
7. Use a logic probe to analyze logic circuits

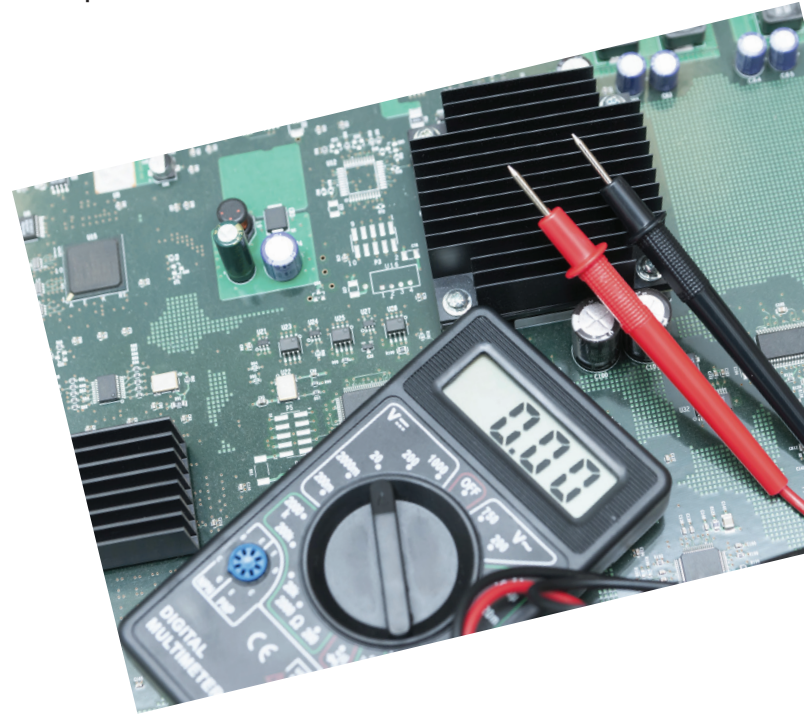
8. Use capacitor/inductor analyzer to test passive circuit elements
9. Use a pulse injector to insert pulses into digital circuitry
10. Use variac
11. Use isolation transformer
12. Use DC power supply
13. Use an AC circuit polarity tester
14. Use an electrical resistance insulation tester (megger)
15. Demonstrate proper care and use of precision measuring tools and instruments
16. Use clamp on meters (volt or amp)
17. Perform metric and standard mechanical measurements
18. Demonstrate proper use of hand tools
19. Demonstrate proper use of power tools



### **Identify Components, Establish Their Value or Parameters Using Common Reference Material and Color Codes, and Test for Proper Function (12 questions)**

1. Distinguish between conductors and insulators –basic materials
2. Identify types of cells and batteries and demonstrate proper storage and handling procedures
3. Identify the types and applications of connectors
4. Identify the types and applications of lamps
5. Identify parts and functions of motors and generators
6. Identify functions of solenoids, relays, and switches
7. Determine resistor values by color code and size
8. Identify diode types and parameters by color codes and/or markings
9. Identify types of transistors and their parameters
10. Identify types of thyristors and their parameters
11. Identify integrated circuit families
12. Identify synchro, servo, and stepper motors, associated components, characteristics, and operations
13. Identify and test circuit protection devices
14. Demonstrate proper handling of static-sensitive devices
15. Identify types and applications of various photo-sensitive devices
16. Determine capacitor values
17. Determine inductor values
18. Identify transformer ratings and lead configurations by color codes and/or markings
19. Identify types of antenna systems and their use

20. Identify and test basic electron tubes
21. Identify and test types and applications of various temperature sensitive devices
22. Test conductors and insulators
23. Test cells and batteries
24. Test connectors
25. Test lamps
26. Test motors and generators
27. Test solenoids, relays, and switches
28. Test resistors
29. Test diodes
30. Test transistors
31. Test thyristors
32. Test integrated circuits
33. Test, synro, servo, and stepper motors
34. Test various photo-sensitive devices
35. Test capacitors
36. Test inductors
37. Test transformers
38. Test antenna systems
39. Identify types/sizes of wire and cable and appropriate applications



## **Demonstrate Proper Soldering and Desoldering Procedures (1 question)**

1. Perform standard soldering and desoldering techniques
2. Perform hot air soldering and desoldering techniques
3. Identify multi-layer boards and demonstrate knowledge of procedural differences
4. Perform surface-mount soldering and desoldering techniques
5. Perform high and low temp soldering

## **Read and Interpret Schematics, Diagrams, and Blueprints (3 questions)**

1. Identify and use common notations and symbols
2. Use schematics, diagrams, and blueprints to locate and identify specific equipment within areas
3. Use schematics, diagrams, and blueprints to interface subassemblies/peripherals
4. Trace signal/power flow

5. Recognize proper waveforms
6. Use schematics, diagrams, and blueprints to construct/assemble equipment
7. Maintain service documentation library/Internet file

## **Interpret and Apply Industry-Specific Codes and Regulations (1 question)**

1. Research and apply appropriate codes and regulations

## **Evaluate Direct Current Circuits (7 questions)**

1. Solve basic algebraic problems as applicable to electronics
2. Relate electricity to nature of matter
3. Identify sources of electricity
  - Chemical
  - Mechanical
  - Thermal
  - Tibro (static)
  - Piezo
  - Photo voltaic
4. Define voltage, current, resistance, power, and energy
5. Apply and relate Ohms Law
6. Measure properties of a circuit using VOM and DVM meters
7. Compute and measure conductance and resistance of conductors and insulators
8. Analyze, construct, and troubleshoot series circuits, parallel circuits, series-parallel circuits, and voltage dividers
9. Define magnetic properties of circuits and devices
10. Apply logical and systematic approach to troubleshooting DC circuits
11. Solve network theorem problems using Kirchhoff, Thevenin, Norton, and Superposition
12. Analyze and measure RL and RC time constants

## **Evaluate Alternating Current Circuits (6 questions)**

1. Identify properties of an AC signal
2. Identify AC sources
3. Set up and operate test equipment for AC circuits
4. Analyze and measure AC signals using proper test equipment
5. Analyze and apply principles in transformers to AC circuits
6. Apply logical and systematic approach to troubleshooting AC circuits
7. Analyze basic motor theory and operation
8. Identify and configure Delta and Wye configurations

9. Analyze basic generator theory and operation
10. Solve basic trigonometric problems as applicable to electronics
11. Construct, analyze, and troubleshoot AC capacitive circuits, AC inductive circuits, RLC circuits (series, parallel, complex) series and parallel resonant circuits, filter circuits, and polyphase circuits
12. Analyze, construct, and troubleshoot maximum power transfer theory

### **Evaluate Common Semi-Conductor Devices (3 questions)**

1. Identify properties of semi-conductor materials
2. Analyze and measure characteristic of P-N junction diodes
3. Analyze and measure characteristics of special diodes
4. Analyze, construct, and troubleshoot diode circuits
5. Identify, define, and measure characteristics of unipolar and bipolar devices, thyristors, and integrated circuits
6. Apply logical and systematic approach to troubleshooting semi-conductor devices
7. Set up and operate test equipment for solid state devices

### **Evaluate Analog Circuit Devices (7 questions)**

1. Analyze, construct, and troubleshoot single stage amplifiers
2. Analyze, construct, and troubleshoot multi-stage amplifiers
3. Analyze, construct, and troubleshoot operational amplifiers
4. Analyze, construct, and troubleshoot basic power supplies and filters
5. Analyze, construct, and troubleshoot oscillators
6. Analyze motor or phase control circuits
7. Apply logical and systematic approach to troubleshooting analog circuit devices
8. Analyze, construct, and troubleshoot power supply regulators
9. Analyze, construct, and troubleshoot active filters
10. Set-up and operate test equipment for analog circuits
11. Troubleshoot switching power supplies
12. Analyze and troubleshoot phase-locked-loop systems



### **Evaluate Digital Logic Devices (4 questions)**

1. Define and apply number systems to codes and arithmetic operations
2. Analyze, construct, and troubleshoot logic gates, logic arithmetic circuits, flip-flops, and encoders and decoders

3. Analyze, construct, and troubleshoot registers and counters, clock and timing circuits, multiplexers and demultiplexers, digital to analog and analog to digital devices, and discrete input/output circuits
4. Analyze, construct, and troubleshoot displays and representative digital systems
5. Apply logical and systematic approach to troubleshooting digital logic devices
6. Set-up and operate test equipment for digital devices

### **Evaluate Microprocessor Systems (1 question)**

1. Analyze and troubleshoot processors
2. Analyze and troubleshoot memory systems
3. Analyze and troubleshoot input/output systems
4. Apply logical and systematic approach to troubleshooting microprocessor systems
5. Analyze and troubleshoot bus systems, protocols, and timing schemes
6. Execute computer instruction sets
7. Demonstrate proper use of system diagnostics

### **Evaluate Communications Techniques and Equipment (1 question)**

1. Test and troubleshoot AM circuits
2. Test and troubleshoot FM circuits
3. Test and troubleshoot specialized analog and digital communications techniques (various pulse modulations, modem, faxes)

### **Generate Technical Documentation (2 questions)**

1. Prepare customer documents used for removal, repair, and reinstallation of an electronic system or component
2. Prepare typical work orders, logbooks, and historical records
3. Perform proper and complete documentation of maintenance and repair actions
4. Research and order parts
5. Demonstrate the ability to properly document engineering changes or field modifications
6. Calculate and prepare a customer billing document
7. Complete work order using electronic documentation

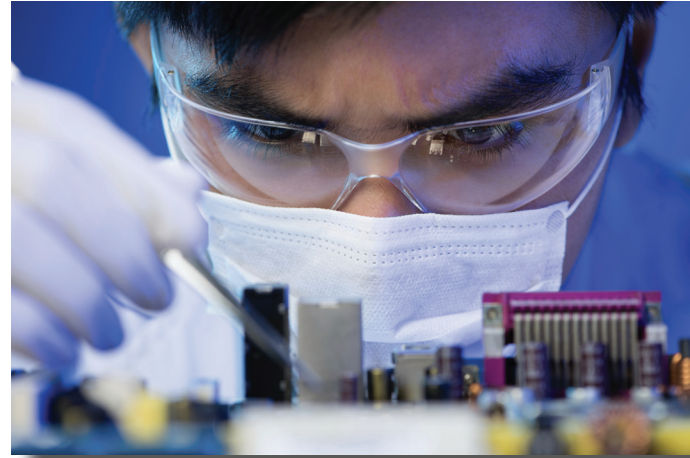


# Standards and Test Content

## Electronics Assembler

### Demonstrate Proper Procedures and Practices for Safety in the Work Area (14 questions)

1. Identify and practice mechanical safety
  - Tool safety
  - Hand safety
  - Eye safety
2. Immediately report injuries/accidents following company procedures
3. Identify and practice electrical safety
4. Participate in “Right to Know” training and practice environmental safety
  - Chemical awareness
  - Environmental regulations
  - Gases and pressure safety
5. Identify and practice safety related to infectious disease, universal precautions, blood-borne pathogens, and chemical hygiene
6. Identify and practice thermal safety
7. Identify and practice radiation safety
8. Demonstrate knowledge of lock-out/tag-out requirements and danger associated with potential energy sources
9. Identify and practice fiber optic handling safety
10. Perform a leakage check on electronic equipment
11. Test electrical equipment to ensure proper grounding
12. Identify sources of hazardous noise



### Demonstrate Employability Skills (4 questions)

1. Maintain a courteous and responsible attitude toward all customers
2. Demonstrate appropriate interpersonal skills
3. Maintain self-esteem in self and others
  - Analyze personal space and needs
  - Interpret emotional reactions
  - Determine values scale and attitudes
  - Cope with change
  - Interpret sensory clues

4. Recognize the importance of teamwork and participate as a team member
  - Participate in team (group) meetings
    - Focus on topic and purpose of the meeting
    - Offer facts and ideas
    - Help others contribute facts and ideas
  - Pass on good ideas
  - Look for ways to help others
  - Give recognition for things well done
  - Let others know what you need to get the job done
5. Maintain professional respect for supervisor and co-workers
6. Use professionalism
  - Follow facility dress code
  - Exhibit positive attitude
  - Exhibit initiative
  - Exhibit loyalty
  - Exhibit respect to others
  - Exhibit flexibility
  - Exhibit commitment
  - Practice hygiene
7. Use critical thinking skills in workplace situations
  - Distinguish appropriateness of equipment and tests
  - Decision making
  - Creativity
  - Use quality performance processes
  - Use tools to analyze information
    - Use basic statistical concepts and analysis
    - Create charts
    - Create histograms
    - Create flow charts
    - Use quality tools
    - Evaluate stressful situations
    - Evaluate how to manage ethical conflicts
8. Maintain satisfactory attendance
  - Punctuality
  - Tardiness
  - Early departure
  - Absence
  - Calling in
9. Use stress management techniques
10. Function within the organizational structure
  - Chain of command
  - Amount of empowerment
11. Distinguish the departments within the organization
12. Distinguish the roles of the organizational members
13. Use self-management and time management techniques
  - Independence
  - Self-evaluation
  - Leadership skills
  - Supervision
  - Delegation
  - Organization
  - Prioritization
  - Initiative
14. Use deductive and inductive reasoning skills

15. Use proper telephone etiquette

- Project positive telephone image
  - Manage incoming telephone calls
    - Receive incoming calls
    - Screen incoming calls
    - Transfer incoming calls when indicated
  - Manage telephone calls
    - Inquiries
  - Manage telephone calls involving special problems
    - Unidentified callers
    - Angry callers
    - Calls from family and friends
  - Manage telephone calls involving medical emergencies
  - Record and deliver telephone calls
    - Local
    - Long distance
    - Conference
  - Use special features if available
  - Identify factors that relate to a global business environment
    - Time zones
    - International dialing codes
  - Use telephone directories
    - Evaluate types and organization of each type
    - Use telephone assistance and information
    - Maintain company directory
- Manage multiple incoming calls
  - Use telephone log or computerized system



16. Employ listening skills

- Show interest
- Ask questions and clarify what has been heard
- Let person know what you understand

17. Compose written communication legibly using correct grammar, spelling, and format

- Compose questions
- Compose consent forms
- Compose student evaluation reports
- Select and use appropriate format for written communication
- Use reference materials as appropriate
- Use proper grammatical techniques
  - Abbreviate for words used in addresses, measurements, months and days of the year
  - Use proper punctuation

18. Interpret and follow written directions and information

19. Interpret and follow oral directions

20. Use job-related terminology, symbols, and abbreviations

21. Use basic keyboarding skills and computer skills
  - E-mail
  - File transfer protocol (FTP)
  - Internet
  - Operating System
  - Office Suite Products
22. Use effective communication techniques with peers, co-workers, and customers
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23. Use verbal and non-verbal communication techniques
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  - Use positive feedback techniques
    - Emphasize strengths
  - Use negative feedback techniques
    - Stress main points the person could do differently
25. Identify personal and work-related goals and monitor progress
  - Chart and set long, medium, and short term goals
  - Determine educational needs
  - Set professional goals
  - Set personal goals
26. Respond to compliments, complaints, conflicts, and criticism appropriately
27. Compile research data
28. Apply electronics-related mathematical concepts
  - Addition, subtraction, multiplication, and division of:
    - Whole numbers
    - Fractions
    - Decimals
    - Percentages
    - Binary mathematics
    - Hexadecimal mathematics
  - Exponents
  - Scientific notations
  - Significant digits
  - Basic trigonometry functions
  - Measurements
    - U.S. to metric
    - Metric to U.S.
  - Use of calculator
  - Concept of coins and currency
  - Estimation
  - Reading charts, graphs, and tables
  - Basic geometry
  - Application of formulas
    - Word problems
    - Thought problems

29. Use negotiation skills

- Interpret how to reasonably disagree
- Interpret ways to overcome objections
- Solve everyday human relation problems

30. Use career development skills

- Write cover/application letter
- Complete job application
- Interpret Form W-2
- Write a job description
- Investigate an occupation
- Explore career opportunities
- Compare career options
- Develop a personal career plan
- Negotiate salary and benefits

31. Use multi-cultural sensitivity skills

- Recognize and respect diverse customs and accommodate them in the work environment

32. Understand anti-discriminatory laws and take steps to comply with laws relating to:

- Gender
- Race
- Disability
- Age
- Religion
- National origin
- Color

## Identify and Demonstrate Proper Use of Industry-Specific Tools and Test Equipment (2 questions)

1. Demonstrate proper use of pneumatic tools
2. Use appropriate instrumentation to test ESD protective systems

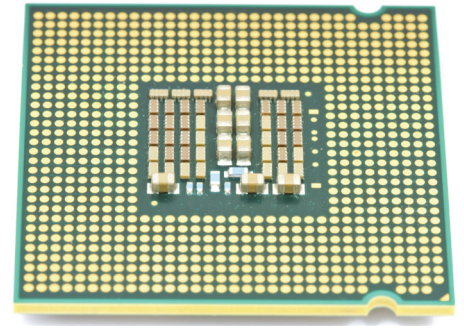
## Identify and Demonstrate Proper Use of Common Tools and Test Equipment (13 questions)

1. Use an analog multimeter to measure:
  - Voltage
  - Current
  - Resistance
2. Use a digital multimeter to measure:
  - Voltage
  - Current
  - Resistance
3. Demonstrate proper care and use of precision measuring tools and instruments
4. Perform metric and standard mechanical measurements
5. Demonstrate proper use of hand tools



## Identify Components, Establish Their Value or Parameters Using Common Reference Material and Color Codes, and Test for Proper Function (14 questions)

1. Distinguish between conductors and insulators –basic materials
2. Identify types of cells and batteries and demonstrate proper storage and handling procedures
3. Identify the types and applications of connectors
4. Identify the types and applications of lamps
5. Identify parts and functions of motors and generators
6. Identify functions of solenoids, relays, and switches
7. Determine resistor values by color code and size
8. Identify diode types and parameters by color codes and/or markings
9. Identify types of transistors and their parameters
10. Identify types of thyristors and their parameters
11. Identify integrated circuit families
12. Identify syncro, servo, and stepper motors, associated components, characteristics, and operations
13. Identify and test circuit protection devices
14. Demonstrate proper handling of static-sensitive devices
15. Identify types and applications of various photo-sensitive devices
16. Determine capacitor values
17. Determine inductor values
18. Identify transformer ratings and lead configurations by color codes and/or markings
19. Identify types/sizes of wire and cable and appropriate applications



## Demonstrate Proper Soldering and Desoldering Procedures (3 questions)

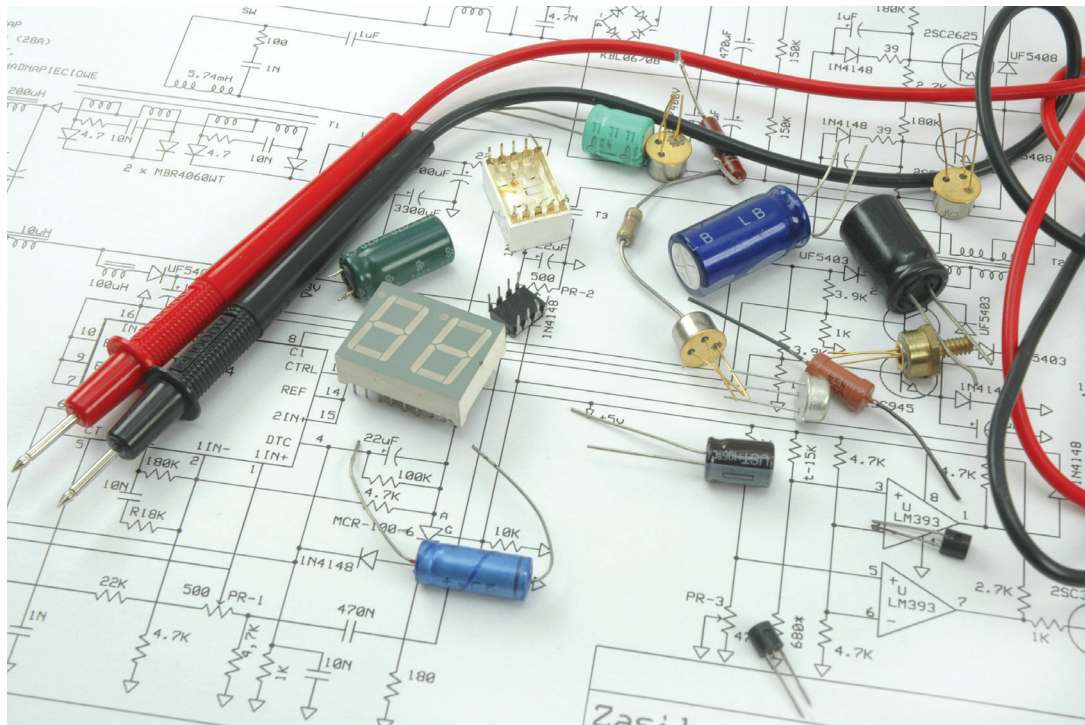
1. Perform standard soldering and desoldering techniques
2. Perform hot air soldering and desoldering techniques
3. Identify multi-layer boards and demonstrate knowledge of procedural differences
4. Perform surface-mount soldering and desoldering techniques
5. Perform high and low temp soldering

## Identify Fasteners and Terminals and Demonstrate Proper Installation Procedures (2 questions)

1. Identify types of fasteners and terminals
2. Demonstrate use of fasteners and terminals
3. Differentiate between types and sizes of screws

## Read and Interpret Schematics, Diagrams, and Blueprints (3 questions)

1. Identify and use common notations and symbols
2. Use schematics, diagrams, and blueprints to locate and identify specific equipment within areas
3. Use schematics, diagrams, and blueprints to interface subassemblies/peripherals
4. Use schematics, diagrams, and blueprints to construct/assemble equipment



## Sample Questions

- \_\_\_\_\_ 1. Which of the following devices represents the greatest electrical shock hazard in a typical PC workstation setup?
- keyboard
  - modem
  - monitor
  - scanner
- \_\_\_\_\_ 2. On an analog meter, the technician notices that the needle moves, but it will not zero on the ohm scale. What should the technician check?
- batteries
  - function switch
  - fuse
  - power switch
- \_\_\_\_\_ 3. The switch on a logic probe allows the user to switch between:
- 5 volts and 120 volts.
  - analog and digital.
  - TTL and CMOS.
  - VRMS and VPP.
- \_\_\_\_\_ 4. What is the round prong on a plug connected to?
- the case
  - the white wire
  - the hot wire
  - the cold wire
- \_\_\_\_\_ 5. Which of the following connectors is female?
- binding post
  - bolt
  - receptacle
  - 3-prong plug
- \_\_\_\_\_ 6. What is used to check the connection at a banana plug with the circuit off?
- ammeter
  - ohmmeter
  - oscilloscope
  - voltmeter



- \_\_\_\_\_ 7. A circuit draws 0.5 amp at 50 volts. How much power is consumed?
- a. 0.5 watts
  - b. 25 watts
  - c. 50 watts
  - d. 250 watts
- \_\_\_\_\_ 8. What is the flow of electrons through an electrical circuit called?
- a. current
  - b. power
  - c. resistance
  - d. voltage
- \_\_\_\_\_ 9. What are two primary characteristics to consider when selecting a replacement diode?
- a. current and PRV
  - b. manufacturer and price
  - c. voltage and resistance
  - d. size and wattage
- \_\_\_\_\_ 10. How many bits are in a byte?
- a. 2
  - b. 4
  - c. 8
  - d. 16



## Sample Questions — Key

1. Which of the following devices represents the greatest electrical shock hazard in a typical PC workstation setup?
  - a. keyboard Incorrect
  - b. modem Incorrect
  - c. monitor Correct
  - d. scanner Incorrect
  
2. On an analog meter, the technician notices that the needle moves, but it will not zero on the ohm scale. What should the technician check?
  - a. batteries Correct
  - b. function switch Incorrect
  - c. fuse Incorrect
  - d. power switch Incorrect
  
3. The switch on a logic probe allows the user to switch between:
  - a. 5 volts and 120 volts. Incorrect
  - b. analog and digital. Incorrect
  - c. TTL and CMOS. Correct
  - d. VRMS and VPP. Incorrect
  
4. What is the round prong on a plug connected to?
  - a. the case Correct
  - b. the white wire Incorrect
  - c. the hot wire Incorrect
  - d. the cold wire Incorrect
  
5. Which of the following connectors is female?
  - a. binding post Incorrect
  - b. bolt Incorrect
  - c. receptacle Correct
  - d. 3-prong plug Incorrect
  
6. What is used to check the connection at a banana plug with the circuit off?
  - a. ammeter Incorrect
  - b. ohmmeter Correct
  - c. oscilloscope Incorrect
  - d. voltmeter Incorrect

7. A circuit draws 0.5 amp at 50 volts. How much power is consumed?

- a. 0.5 watts                      **Incorrect**
- b. 25 watts                        **Correct**
- c. 50 watts                        **Incorrect**
- d. 250 watts                      **Incorrect**

8. What is the flow of electrons through an electrical circuit called?

- a. current                         **Correct**
- b. power                         **Incorrect**
- c. resistance                    **Incorrect**
- d. voltage                        **Incorrect**

9. What are two primary characteristics to consider when selecting a replacement diode?

- a. current and PRV              **Correct**
- b. manufacturer and price      **Incorrect**
- c. voltage and resistance      **Incorrect**
- d. size and wattage              **Incorrect**

10. How many bits are in a byte?

- a. 2                                **Incorrect**
- b. 4                                **Incorrect**
- c. 8                                **Correct**
- d. 16                              **Incorrect**

## Abbreviations, Symbols and Acronyms

The following is a list of abbreviations, symbols, and acronyms used in the Electronics study guide and on the General Electronics Technician, and Electronic Assembler assessments.

$\Omega$	ohms
#	number
%	percentage
AC	alternating current
AM	amplitude modulation
A/amp	ampere
AND	logic gate
$A_v$	voltage amplification
Bpm	beats per minute
BJT	bipolar junction transistor
BOCA	Building Officials Code Administration
CENELEC	European Committee for Electrotechnical Standardization
CFR	Code of Federal Regulations
CMOS	complementary metal oxide semiconductor
CSA	Compliance, Safety, Accountability
CT	computed tomography
DC	direct current
DIP	dual in-line package
DVM	digital voltmeter
ECG	electrocardiography
ESD	electrostatic discharge
FM	Factory Mutual
FM	frequency modulation
FTP	File Transfer Protocol
HZ	hertz
IC	integrated circuit
IEP	Individualized Education Plan
JCAHO	Joint Commission on Accreditation of Healthcare
JFET	junction gate field-effect transistor
K	kilo
KHZ	kilohertz
LCD	liquid-crystal display
m	meter
mA	milliamperere
mH	millihenry
MOSFET	metal-oxide-semiconductor field-effect transistor
ms	millisecond
MSI	medium scale integration
MSDS	Material Safety Data Sheet
NAND	negative (AND) gate
NEC	National Electrical Code
NFPA	National Fire Protection Association
NPN	bipolar transistor that is “not pointing in”

NSSB	National Skills Standards Board
OR	digital logic gate
OSHA	Occupational Safety and Health Administration
PC	personal computer
PCB	printed circuit board
PET	positron emission tomography
pF	micromicorfarad
PNP	bipolar transistor that is “pointing in permanently”
PRV	peak reverse voltage
RC	resistor-capacitor
RL	resistor-inductor
RLC	series, parallel, complex
RMS	root mean square
SAE	Society of Automotive Engineers
SCR	silicon-controlled rectifier
SMT	surface-mount technoloty
SSI	synchronous serial interface
TTL	transistor-transistor logic
uA	microampere
μF	microfarad
UL	Underwriters Laboratories
USB	Universal Serial Bus
V/volt	voltage
VAC	voltage AC
VOM	Volt-Ohm meter
VRMS	voltage root mean square
W	watt
XOR	exclusive OR (digital logic gate)

## Test Taking Strategies

This section of the study guide contains valuable information for testing success and provides a common-sense approach for preparing for and performing well on any test.

### General Testing Advice

1. Get a good night's rest the night before the test — eight hours of sleep is recommended.
2. Avoid junk food and “eat right” several days before the test.
3. Do not drink a lot or eat a large meal prior to testing.
4. Be confident in your knowledge and skills!
5. Relax and try to ignore distractions during the test.
6. Focus on the task at hand — taking the test and doing your best!
7. Listen carefully to the instructions provided by the exam proctor. If the instructions are not clear, ask for clarification.

### Testing Tips

1. Read the entire question before attempting to answer it.
2. Try to answer the question before reading the choices. Then, read the choices to determine if one matches, or is similar, to your answer.
3. Do not change your answer unless you misread the question or are certain that your first answer is incorrect.
4. Answer questions you know first, so you can spend additional time on the more difficult questions.
5. Check to make sure you have answered every question before you submit the assessment for scoring — unanswered questions are marked incorrect.





