Electronics, Introduction

Exam Information

Exam number
651

Items
39

Points
70

Prerequisites
None

Recommended course length
One semester

National Career Cluster
Manufacturing
Science, Technology, Engineering, & Mathematics

Performance standards
Included (Optional)

Certificate available
Yes

Description

The Electronics 1 industry certification exam assesses the ability to apply technical knowledge and knowledge of skills to assemble and operate electrical/electronic equipment used in business, industry, and manufacturing. Learners demonstrate their understanding of safety, electrical theory, parallel and series circuits, Kirchhoff's Laws, schematic diagrams, electrical components, and soldering.

Exam Blueprint

Standard	Percentage of exam
1. Safety Practices	12%
2. Electricity & Electrical Theory	47%
3. Electronic Components	27%
4. Electrical Testing Equipment & Troubleshooting Techniques	14%

STANDARD 1

Students will understand, demonstrate, and practice safe working habits in an electronics lab.

Objective 1 Students will demonstrate a habit of Electrical Safety.

1. Students will demonstrate safety while using test equipment.
2. Students will properly care and maintenance of test equipment.

Objective 2 Demonstrate safe use of a Soldering Iron

1. Students will identify potential hazards before and during use and take proper precautions.
2. Students will properly care for, maintain, and store soldering irons and soldering materials (solder, wick, tips, etc.)

Objective 3 Students will recognize safety hazards and demonstrate the proper behaviors to remove or minimize hazards.

1. Clean as you go
2. Always wear safety glasses and appropriate PPE (Personal Protective Equipment).
3. Deenergize circuits/equipment before testing. Demonstrate proper safety while testing/trouble shooting.

Performance Skills

1. Students can complete a safety test without error (100%) before using any tools or shop equipment.
2. Students will demonstrate proper use of PPE.
3. Students will demonstrate safe practices while working with electricity.

Standard 1 Performance Evaluation included below (Optional)

STANDARD 2

Students will understand the fundamental principles of electricity and electrical theory.

Objective 1 Students will learn the basic structure of an atom

1. Protons
2. Neutrons

3. Electrons

Objective 2 Identify conductors and insulators and understand their differences at an atomic level.

Objective 3 Understand how electricity is produced by the flow of electrons.

1. Students can identify voltage sources and explain/demonstrate their operation.
    a. Battery cell
        i. Primary
        ii. Secondary
    a. Thermocouple
    b. Photovoltaic cell
1. Students can demonstrate application of batteries in series aiding and opposing configurations.
2. Students can demonstrate application of batteries in parallel configuration

Objective 4 Define electrical units of measure:

Term	Description	Symbol	Unit of Measure	Symbol of Base Units
Charge	Quantity of Accumulated Electrons	Q	Coulombs	C
Voltage	Electrical Potential Difference	V	Volts	V
Current	Rate of Electron Flow	I	Amps	A
Resistance	Opposition to Electron Flow	R	Ohms	Ω
Power	Rate of doing Electrical Work	P	Watts	W

Objective 5 Define the difference between AC and DC electricity.

Objective 6 Understand the relation between voltage, current, resistance, and power using the following laws:

1. Ohm's Law
    a. Current is directly proportional to voltage and inversely proportional to resistance.
    b. V=IR
2. Watt's Law
    a. Power in a component is the product of the voltage and the current.
    b. P=IV

Objective 7 Student will understand the principles of a series circuit.

1. Kirchoff's Voltage Law
    a. Sum of the voltage drops equals the voltage source.
    b. Voltage drops are additive.
2. Current is constant in series circuits.
3. Resistance is additive.
4. Power is additive.

Objective 8 Students will understand the principles of a parallel circuit.

1. Kirchoff's Current Law
    a. Sum of the current flowing into a node is equal to the current flowing out of a node.
2. Resistance is the inverse of the sum of the inverses of the individual branches.
3. Voltage is constant across each of the individual branches.
4. Power is additive.

Performance Skills

1. Students can identify and define:
    a. Voltage: An electromotive force or the potential difference expressed in volts
    b. Current: A flow of charged particles (electrons) moving through a conductor.
    c. Resistance: is a measure of the object's opposition to electrical current.
    d. Power: The rate of transfer of electrical energy in a circuit.
2. Students can calculate power, voltage, current, and resistance in a series circuit.
3. Students can calculate power, voltage, current, and resistance in a parallel circuit.
4. Students can calculate voltage, current, or resistance when given only two of the three values using proper units.

Standard 2 Performance Evaluation included below (Optional)

STANDARD 3

Students will be able to understand and demonstrate how to use, test, and select electronic components.

Objective 1 Identify the following electrical components and their schematic symbols:

1. Battery/Cell
2. Resistor

3. Incandescent light bulb
4. Light Emitting Diode (LED)
5. Motor
6. Normally-open (N.O) switch
7. Normally-closed (N.C) switch
8. Single-pole single-throw switch (SPST)
9. Single-pole double-throw switch (SPDT)
10. Wire

Objective 2 Students can read and understand the resistor color code.

Objective 3 Students will learn how to use a breadboard.

Objective 4 Students will learn how printed circuit boards are made and how they work.

Objective 5 Students will learn how to safely use a soldering iron to solder components to a printed circuit board.

1. Correctly tinning a soldering iron
2. Proper heating of pad and component lead
3. Proper care and maintenance of soldering irons and materials

Performance Skills

1. Students can accurately read an electrical schematic drawing.
2. Students can identify the value of a resistor using the resistor color code.
3. Students can create a working circuit using a breadboard.
4. Students can select the proper components based on an electrical schematic drawing.

Standard 3 Performance Evaluation included below (Optional)

STANDARD 4

Students will demonstrate the proper use of electrical testing equipment and troubleshooting techniques.

Objective 1 Students will learn to make accurate measurements, use, and maintenance of an Ohmmeter.

Objective 2 Students will learn proper placement and use of a voltmeter.

Objective 3 Students will learn proper placement and use of an ammeter including placement for accurate measurement in a circuit.

Objective 4 Students will learn proper use and safety of a DC voltage source in testing circuits.

Objective 5 Students will understand the effects of an “open” on a series or parallel circuit.

Objective 6 Students will understand the effects of a “short” on a series or parallel circuit.

Performance Skills

1. Students can use a digital multimeter to measure voltage, current, and resistance.
2. Students can troubleshoot and correct open and short circuits.

Electronics 1

Performance assessments may be completed and evaluated at any time during the course. The following performance skills are to be used in connection with the associated standards and exam. To pass the performance standard the student must attain a performance standard average of 8 or higher on the rating scale. Students may be encouraged to repeat the objectives until they average 8 or higher.

Student’s Name: _____

Class: _____

Performance standards rating scale

0	Limited skills	2	→	4	Moderate skills	6	→	8	High skills	10

Standard 1 – Safety Practices **Score:**

- Follow safety practices.

Standard 2 – Test Equipment **Score:**

- Understand and demonstrate the use of test equipment.

Standard 3 – Passive Electronic Components **Score:**

- Understand and demonstrate how to use, test, and select, passive electronic components.

Standard 4 – Solder and Desolder Components **Score:**

- Demonstrate the ability to successfully solder components to and desolder components from a printed circuit board.

Standard 5 – Basic Electronic Theory **Score:**

- Understand and demonstrate basic electronic theory.

Performance standard average score:

Evaluator Name: _____

Evaluator Title: _____

Evaluator Signature: _____

Date: _____