

**Technical and Professional  
Education**

**Curriculum Content Frameworks for  
Aviation Technology**

**Curriculum Content Frameworks for  
Aviation Technology  
Developed by the  
Department of Workforce Education**

**State of Arkansas  
Department of Workforce Education**

## **NOTICE TO THE READER**

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## **Preface**

The Technical & Professional Education program continues to prepare students for employment and continuing education. To accomplish this preparation, teachers and employers have collaborated to modify individual programs to ensure that instruction is current and comprehensive. This document reflects essential competencies for program completers as well as all aspects of the aviation industry as required by the Carl D. Perkins Act. The Curriculum Content Frameworks for all Technical & Professional Education programs can be accessed through the Department of Workforce Education Web site.

## Foreword

The curriculum content framework Aviation supports the course that prepares students for the following career roles, which in turn correspond to the Classification of Instructional Programs (CIP) codes listed below. The courses may be sequenced with a variety of career and technical courses to form a specialization to prepare students for careers and support additional education and training in the protective services industry.

- Career Family: Technical & Professional Education
- Career Area: Aviation Technology
- Career Role CIP Code: 47.0608  
47.0609

## **Acknowledgments**

The Aviation curriculum content framework was produced by a team of program developers from the University of Arkansas at Little Rock. A panel of experts in the field of aviation reviewed the framework. The format and content of the framework reflect the specific training needs within the state of Arkansas. The framework content and format are modeled after a document originally developed by a writing team under the auspices of the Virginia Department of Education. Grateful appreciation is expressed to the Virginia Department of Education for granting the Arkansas State Department of Workforce Education access to its instructional frameworks.

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# **Introduction**

## **About the Program**

This program of study prepares students for careers in the aviation maintenance industry. The course sequence focuses on duties and tasks performed by professionals in aviation mechanics as well as pre-employment and employment skills.

## **About the Document**

- Section 1 contains a master duty/task list for the Aviation Technology program.
- Section 2 contains an analysis of each task, consisting of the task, task definition, and process/skill questions, to evaluate acceptable performance. All tasks have been designated essential. Essential tasks are those that must be achieved by every student pursuing the completion of the Aviation Technology program.
- Section 3 lists the Arkansas Standards of Learning for language arts, mathematics, and science that are reinforced by instruction in the Aviation Technology program. Academic skills in these areas are necessary for the mastery of a number of tasks performed in the Aviation Technology program.

## **Course Descriptions**

**494250 – Aviation I**

**494260 – Aviation II**

Aviation Technology prepares students for a career in aircraft maintenance. The program of study follows the guidelines established by the Federal Aviation Administration.

## Master Duty/Tasks Listing

National and state experts in the occupational field of aviation technology have validated the duties and tasks in this section. Each is analyzed by identifying the following:

- a *duty/task statement*, which describes what the student is to do.

<b><i>MATHEMATICS</i></b>
<b>DUTY A:</b> <b>Extract roots, and raise numbers to a given power</b>
<b>Task:</b>
A001: Recognize and apply formulas involving the power of a number
<b>DUTY B:</b> <b>Determine areas and volumes of various geometrical shapes</b>
<b>Task:</b>
B001: Apply formulas to determine areas and volumes
B002: Compute wing area
B003: Calculate the volume of baggage compartments and fuel tanks
B004: Compute piston displacement
<b>DUTY C:</b> <b>Solve ratio, proportion, and percentage problems</b>
<b>Task:</b>
C001: Convert fractional numbers to decimal equivalents
C002: Determine ratio and percentage of numbers
C003: Compute compression ratios

<b>DUTY D:</b> <b>Perform algebraic operations involving addition, subtraction, multiplication, and division of positive and negative numbers</b>
<b>Task:</b>
D001: Recognize and apply algebraic applications
<b><i>AIRCRAFT DRAWINGS</i></b>
<b>DUTY A:</b> <b>Use aircraft drawings, symbols, and system schematics</b>
<b>Task:</b>
A001: Identify lines and symbols
A002: Interpret dimensions
A003: Interpret electrical system drawings
A004: Use installation diagrams and schematics
<b>DUTY B:</b> <b>Draw sketches of repairs and alterations</b>
<b>Task:</b>
B001: Make sketches
<b>DUTY C:</b> <b>Use blueprint information</b>
<b>Task:</b>
C001: Read and interpret drawings
C002: Interpret installation diagrams
<b>DUTY D:</b> <b>Use graphs and charts</b>
<b>Task:</b>
D001: Use manufacturer's charts and graphs
<b><i>BASIC PHYSICS</i></b>
<b>DUTY A:</b> <b>Use and understand the principles of simple machines: sound, fluid, and heat dynamics; basic aerodynamics; aircraft structures; and theory of flight</b>
<b>Task:</b>
A001: Determine the relationship of temperature and heat

A002: Determine the relationship of pressure, temperature, and volume of air mass
A003: Identify the factors affecting air pressure on an airfoil
A004: Identify the physical factors affecting engine output power
A005: Determine the relationship of pressure, area, and force
A006: Define <i>inclined plane</i> , <i>level</i> , and <i>pulley</i>
A007: Explain the origin of sound
A008: Define <i>centrifugal/centripetal force</i>
<b><i>BASIC ELECTRICITY</i></b>
<b>DUTY A:</b>
<b>Determine the relationship of voltage, current, and resistance in electrical circuits</b>
<b>Task:</b>
A001: Calculate current
A002: Calculate voltage drop
A003: Determine the current flow-carrying capacity of wire
A004: Calculate electrical power
A005: Measure current flow in a parallel electrical circuit
A006: Demonstrate the characteristics of magnetism
A007: Demonstrate electromagnetic induction
<b>DUTY B:</b>
<b>Measure voltage, current, resistance, continuity, and leakage</b>
<b>Task:</b>
B001: Explain the meaning of electrical quantity prefixes
B002: Demonstrate the use of DC electrical instruments
B003: Connect voltage and ammeters
B004: Demonstrate the use of a voltmeter
B005: Use an ohmmeter and/or test light for open or short circuits

B006: Detect electrical leakage
B007: Measure AC voltage
<b>DUTY C:</b> <b>Calculate and measure capacitance and inductance</b>
<b>Task:</b>
C001: Define <i>capacitance</i> , <i>inductance</i> , and <i>impedance</i>
C002: Measure capacitance in aircraft applications
<b>DUTY D:</b> <b>Calculate and measure electrical power</b>
<b>Task:</b>
D001: Determine aircraft electrical power requirements
<b>DUTY E:</b> <b>Read and interpret aircraft electrical circuit diagrams, including solid state devices and logic functions</b>
<b>Task:</b>
E001: Identify commonly used aircraft electrical and electronic symbols
E002: Read and interpret circuits with aircraft wiring diagrams
E003: Interpret electronic symbols and schematics in aircraft use, including solid state devices and logic functions
E004: Identify electrical malfunctions by reference to circuit diagrams
<b>DUTY F:</b> <b>Inspect and service batteries</b>
<b>Task:</b>
F001: Understand principles of battery construction and operation
F002: Identify characteristics of aircraft storage batteries
F003: Inspect and recharge aircraft storage batteries
F004: Perform removal, installation, and compartment maintenance of aircraft batteries
<b><i>FLUID LINES AND FITTINGS</i></b>
<b>DUTY A:</b> <b>Fabricate and install rigid and flexible fluid lines and fittings</b>
<b>Task:</b>

A001: Bend aluminum and stainless steel tubing
A002: Perform beading of tubing
A003: Fabricate flares on tubing
A004: Fabricate and install flexible hoses
A005: Recognize defects in metal tubing
A006: Install a section of tubing
<b><i>MATERIALS AND PROCESSES</i></b>
<b>DUTY A: Perform precision measurements</b>
<b>Task:</b>
A001: Inspect aircraft components for wear
<b>DUTY B: Identify and select aircraft hardware and materials</b>
<b>Task:</b>
B001: Identify and install aircraft bolts
B002: Identify aluminum alloys
B003: Identify steel alloys
B004: Recognize economic and engineering criteria in selection of aircraft materials
B005: Identify rivets by physical characteristics
B006: Identify materials used in aircraft firewalls and exhaust shrouds
B007: Determine suitability of materials for aircraft repairs
B008: Identify aircraft control cable
<b>DUTY C: Perform basic heat-treating processes</b>
<b>Task:</b>
C001: Identify effects of heat treatment
C002: Identify aluminum alloy code designation of heat treatability

C003: Identify heat-treatment processes and strain relieving
C004: Anneal copper and steel parts
<b>DUTY D: Perform dye penetrant, eddy current, ultrasonic, and magnetic particle inspection</b>
<b>Task:</b>
D001: Perform dye penetrant, eddy current, and ultrasonic inspections
D002: Perform magnetic particle inspections
D003: Perform inspections of welded assemblies
D004: Perform tests to distinguish between heat-treatable and weldable aluminum alloys
<b>DUTY E: Inspect and check welds</b>
<b>Task:</b>
E001: Inspect and evaluate welds
<b>DUTY F: Identify and select appropriate nondestructive testing methods</b>
<b>Task:</b>
F001: Identify aircraft uses for nondestructive testing
F002: Discuss eddy current inspections
<b><i>CLEANING AND CORROSION CONTROL</i></b>
<b>DUTY A: Identify ABND select cleaning materials</b>
<b>Task:</b>
A001: Identify caustic materials
A002: Identify cleaning agents for aircraft engine parts
<b>DUTY B: Inspect, identify, remove, and treat aircraft corrosion, and perform aircraft cleaning</b>
<b>Task:</b>
B001: Inspect and clean exterior of aircraft
B002: Identify corrosion
B003: Remove corrosion

B004: Apply protective coatings
B005: Remove rust
B006: Clean rubber products
<b><i>GROUND OPERATION AND SERVICING</i></b>
<b>DUTY A:</b> <b>Identify and select fuels</b>
<b>Task:</b>
A001: Identify aircraft fuels
<b>DUTY B:</b> <b>Start, ground operate, move, service, and secure aircraft, and identify typical ground operation hazards</b>
<b>Task:</b>
B001: Start and operate aircraft engines
B002: React to fire in induction system
B003: Direct the movement of aircraft, and identify typical ground operation hazards
B004: Prepare an aircraft for outside storage
<b><i>MAINTENANCE PUBLICATIONS</i></b>
<b>DUTY A:</b> <b>Demonstrate ability to read, comprehend, and apply information contained in FAA and manufacturer's aircraft maintenance specifications, data sheets, manuals, publications, and related federal aviation regulations, airworthiness directives, and advisory material</b>
<b>Task:</b>
A001: Locate reference data
A002: Use information from aircraft specifications
A003: Use information from the manufacturer's manuals to verify control surface travel
A004: Identify and relate regulations governing airworthiness certificates
A005: Select and use technical standard orders
A006: Use manufacturer's manuals and other publications

A007: Select and use supplementary type certificates, airworthiness directives, and advisory materials
<b>DUTY B: Read technical data</b>
<b>Task:</b>
B001: Read, understand, and relate technical information
<b><i>MECHANIC PRIVILEGES AND LIMITATIONS</i></b>
<b>DUTY A: Exercise mechanic privileges within the limitations prescribed by FAR 65</b>
<b>Task:</b>
A001: Interpret FAR 65
A002: Classify aircraft repairs
A003: Interpret regulations governing repairs and alterations
A004: Interpret repair station regulations
A005: Recognize legal and ethical responsibilities
<b><i>MAINTENANCE FORMS AND RECORDS</i></b>
<b>DUTY A: Write a description of work performed, including aircraft discrepancies and corrective action, using typical aircraft maintenance records</b>
<b>Task:</b>
A001: Inspect an aircraft, and prepare a condition report
A002: Write a description of major/minor repairs and routine maintenance
<b>DUTY B: Complete required maintenance forms, records, and inspection reports</b>
<b>Task:</b>
B001: Make maintenance record entries
B002: Use inspection guides
B003: Evaluate aircraft records for compliance with Federal Air Regulations

<b><i>WEIGHT AND BALANCE</i></b>
<b>DUTY A:</b> <b>Weight aircraft</b>
<b>Task:</b> A001: Locate, interpret, and apply weight and balance information
<b>DUTY B:</b> <b>Perform complete weight and balance check, and record data</b>
<b>Task:</b> B001: Solve weight and balance problems
B002: Compute forward and after loaded center of gravity
B003: Compute effect of equipment changes and loading schedules
B004: Compute weight and balance on a helicopter
B005: Examine weight and balance records

## Task Definitions

National and state experts in the occupational field of aviation technology have validated tasks in this section. Each task is analyzed by identifying the following:

- a *task definition* (criteria for acceptable performance), which explains what the student has to do to perform the task at the expected level of mastery;
- *process/skill questions*, which assess student knowledge and performance.

Tasks are arranged by instructional duty area only. The placement of tasks into specific courses and the sequencing of tasks for instruction are local decisions based on student needs, employer demand, and school schedules.

<b><i>MATHEMATICS</i></b>
<b>DUTY A:</b> <b>Extract roots, and raise numbers to a given power</b>
<b>Task:</b>
<b>A001: Recognize and apply formulas involving the power of a number</b>
<i>Definition:</i> Process should include the following: <ul style="list-style-type: none"><li>• Student must be able to demonstrate knowledge of general principles and extract roots of a given number with a high degree of practical application</li><li>• Student must be able to demonstrate knowledge of general principles and raise numbers to a given power with a high degree of practical application</li></ul>
Process/Skill Questions
<b>DUTY B:</b> <b>Determine areas and volumes of various geometrical shapes</b>
<b>Task:</b>
<b>B001: Apply formulas to determine areas and volumes</b>
<i>Definition:</i> Process should include the following: <ul style="list-style-type: none"><li>• Student must be able to demonstrate knowledge of general principles and determine the area of various geometrical shapes with a high degree of practical application</li><li>• Student must be able to demonstrate knowledge of general principles and determine the volume of various geometrical shapes with a high degree of practical application</li></ul>
Process/Skill Questions
<b>B002: Compute wing area</b>
<i>Definition:</i> Process should include the following: <ul style="list-style-type: none"><li>• Student must be able to demonstrate knowledge of general principles and compute the wing area of straight planform wings with a high degree of practical application</li><li>• Student must be able to demonstrate knowledge of general principles and compute the</li></ul>

- wing area of delta-shaped wings with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and compute the wing area of tapered planform wings with a high degree of practical application

Process/Skill Questions

**B003: Calculate the volume of baggage compartments and fuel tanks**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and calculate the volume of a given baggage compartment with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and calculate the volume of a given fuel tank with a high degree of practical application

Process/Skill Questions

**B004: Compute piston displacement**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and compute single piston displacement with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and compute multiple piston engine displacement with a high degree of practical application

Process/Skill Questions

**DUTY C:  
Solve ratio, proportion, and percentage problems**

**Task:**

**C001: Convert fractional numbers to decimal equivalents**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and convert fractions to their decimal equivalent with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and convert decimals, with a high degree of practical application, to their fraction equivalent in its lowest terms

Process/Skill Questions

**C002: Determine ratio and percentage of numbers**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and determine unknown variables of ratio and proportion problems with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and determine percentage of numbers with a high degree of practical application

Process/Skill Questions

**C003: Compute compression ratios**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and compute compression ratios with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and demonstrate, with a high degree of practical application, the effects of piston displacement size with respect to compression ratio

Process/Skill Questions

**DUTY D:****Perform algebraic operations involving addition, subtraction, multiplication, and division of positive and negative numbers****Task:****D001: Recognize and apply algebraic applications**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and perform, with a high degree of practical application, algebraic operations, involving addition, subtraction, multiplication, and division of positive numbers
- Student must be able to demonstrate knowledge of general principles and perform, with a high degree of practical application, algebraic operations, involving addition, subtraction, multiplication, and division of negative numbers
- Student must be able to demonstrate knowledge of general principles and perform, with a high degree of practical application, algebraic operations, involving addition, subtraction, multiplication, and division of positive and negative numbers

Process/Skill Questions

***AIRCRAFT DRAWINGS*****DUTY A:****Use aircraft drawings, symbols, and system schematics****Task:****A001: Identify lines and symbols**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to interpret aircraft drawings
- Student must be able to demonstrate knowledge of general principles and manipulative skills to identify commonly used drawing symbols

Process/Skill Questions

**A002: Interpret dimensions**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to interpret dimensions
- Student must be able to demonstrate knowledge of general principles and manipulative skills to calculate unknown dimensions with the use of known dimensions

Process/Skill Questions

**A003: Interpret electrical system drawings**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to interpret electrical system drawings
- Student must be able to demonstrate knowledge of general principles and manipulative skills to identify commonly used electrical system drawing symbols

Process/Skill Questions

**A004: Use installation diagrams and schematics**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to use installation diagrams
- Student must be able to demonstrate knowledge of general principles and manipulative skills to use schematics

Process/Skill Questions

**DUTY B:  
Draw sketches of repairs and alterations****Task:****B001: Make sketches**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and draw sketches of repairs with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and draw sketches of alterations with a high degree of practical application

Process/Skill Questions

**DUTY C:  
Use blueprint information****Task:****C001: Read and interpret drawings**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and use blueprint

information with a high degree of practical application

- Student must be able to demonstrate knowledge of general principles and interpret blueprint information with a high degree of practical application

Process/Skill Questions

**C002: Interpret installation diagrams**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and use installation diagrams with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and interpret installation diagrams with a high degree of practical application

Process/Skill Questions

**DUTY D:  
Use graphs and charts**

**Task:**

**D001: Use manufacturer's charts and graphs**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and read and use graphs with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and read and use charts with a high degree of practical application

Process/Skill Questions

***BASIC PHYSICS***

**DUTY A:  
Use and understand the principles of simple machines: sound, fluid, and heat dynamics;  
basic aerodynamics; aircraft structures; and theory of flight**

**Task:**

**A001: Determine the relationship of temperature and heat**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles of heat transfer
- Student must be able to demonstrate knowledge of general principles of conversion of chemical energy to heat energy

Process/Skill Questions

**A002: Determine the relationship of pressure, temperature, and volume of air mass**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to discuss Boyle's law
- Student must be able to demonstrate knowledge of general principles and manipulative skills to discuss Pascal's law

Process/Skill Questions

**A003: Identify factors affecting air pressure on an airfoil**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of Bernoulli's principles of fluid dynamics and the manipulative skills to use those principles
- Student must be able to demonstrate knowledge of general principles and manipulative skills to discuss factors affecting lift on an airfoil

Process/Skill Questions

**A004: Identify the physical factors affecting engine output power**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles of the power output of internal combustion engines and the manipulative skills to use those principles
- Student must be able to demonstrate knowledge of general principles of the power limitation factors of internal combustion engines and the manipulative skills to use those principles

Process/Skill Questions

**A005: Determine the relationship of pressure, area, and force**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles of pressure per unit area and the manipulative skills to use those principles
- Student must be able to demonstrate knowledge of general principles of force per unit area and the manipulative skills to use those principles

Process/Skill Questions

**A006: Define *inclined plane, level, and pulley***

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to use the inclined plane and understand the mechanical advantage offered by its use
- Student must be able to demonstrate knowledge of general principles and manipulative skills to use the level and understand the mechanical advantage offered by its use

- Student must be able to demonstrate knowledge of general principles and manipulative skills to use the pulley and understand the mechanical advantage offered by its use

Process/Skill Questions

**A007: Explain the origin of sound**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles of the theory of sound propagation and the manipulative skills to use those principles
- Student must be able to demonstrate knowledge of general principles of Mach numbers and the manipulative skills to use those numbers

Process/Skill Questions

**A008: Define *centrifugal/centripetal force***

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles of centrifugal force and the manipulative skills to perform basic operations of defining it
- Student must be able to demonstrate knowledge of general principles of centripetal force and the manipulative skills to perform basic operations of defining it

Process/Skill Questions

***BASIC ELECTRICITY***

**DUTY A:**

**Determine the relationship of voltage, current, and resistance in electrical circuits**

**Task:**

**A001: Calculate current**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to determine and calculate current when given the voltage and resistance of a circuit
- Student must be able to demonstrate knowledge of general principles and manipulative skills to determine and calculate voltage when given the current and resistance of a circuit

Process/Skill Questions

**A002: Calculate voltage drop**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to calculate voltage drop across individual electrical components of a circuit
- Student must be able to demonstrate knowledge of general principles and manipulative skills to calculate voltage drop across a total circuit

Process/Skill Questions

**A003: Determine the current flow-carrying capacity of wire**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to determine the current flow-carrying capacity of various conductive materials
- Student must be able to demonstrate knowledge of general principles and manipulative skills to determine the current flow-carrying capacity of a given wire, using the applicable wire chart

Process/Skill Questions

**A004: Calculate electrical power**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to calculate the electrical power of an electrical circuit, using the given voltage and amperage of the circuit
- Student must be able to demonstrate knowledge of general principles and manipulative skills to calculate the electrical power of an electrical circuit, using the given voltage and resistance of the circuit

Process/Skill Questions

**A005: Measure current flow in a parallel electrical circuit**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to measure current flow in a parallel electrical circuit, using an ammeter
- Student must be able to demonstrate knowledge of general principles and manipulative skills to measure and calculate current flow in a parallel electrical circuit, using a volt and ohmmeter and Ohm's law

Process/Skill Questions

**A006: Demonstrate the characteristics of magnetism**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to demonstrate the characteristics of polarity effects of magnetism
- Student must be able to demonstrate knowledge of general principles and manipulative skills to demonstrate the characteristics of effects of magnetism on ferrous metals

Process/Skill Questions

**A007: Demonstrate electromagnetic induction**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to use electromagnetic induction

- Student must be able to demonstrate knowledge of general principles and manipulative skills to use electromagnetic induction with a specific focus on transformer principles

Process/Skill Questions

**DUTY B:  
Measure voltage, current, resistance, continuity, and leakage**

**Task:**

**B001: Explain the meaning of electrical quantity prefixes**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of the definition of voltage
- Student must be able to demonstrate knowledge of the definition of current or amps
- Student must be able to demonstrate knowledge of the definition of resistance or ohms
- Student must be able to demonstrate knowledge of the definition of continuity
- Student must be able to demonstrate knowledge of the definition of leakage

Process/Skill Questions

**B002: Demonstrate the use of DC electrical instruments**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to use an ammeter
- Student must be able to demonstrate knowledge of general principles and manipulative skills to use a voltmeter
- Student must be able to demonstrate knowledge of general principles and manipulative skills to use an ohmmeter

Process/Skill Questions

**B003: Connect voltage and ammeters**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to connect voltmeters into circuits
- Student must be able to demonstrate knowledge of general principles and manipulative skills to connect ammeters into circuits

Process/Skill Questions

**B004: Demonstrate the use of a voltmeter**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to show the usefulness of a voltmeter

Process/Skill Questions

**B005: Use an ohmmeter and/or test light for open or short circuits**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to use an ohmmeter and/or test light to check for open circuits
- Student must be able to demonstrate knowledge of general principles and manipulative skills to use an ohmmeter and/or test light to check for short circuits

Process/Skill Questions

**B006: Detect electrical leakage**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles of electrical leakage
- Student must be able to demonstrate knowledge of general principles and manipulative skills to detect electrical leakage

Process/Skill Questions

**B007: Measure AC voltage**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to measure AC voltage
- Student must demonstrate knowledge of peak and root mean square voltage

Process/Skill Questions

**DUTY C:  
Calculate and measure capacitance and inductance**

**Task:**

**C001: Define *capacitance, inductance, and impedance***

*Definition:* Process should include the following:

- Student must be able to define capacitance
- Student must be able to define inductance
- Student must be able to define impedance

Process/Skill Questions

**C002: Measure capacitance in aircraft applications**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of procedures used to measure capacitance
- Student must be able to demonstrate knowledge of general principles and measure capacitance with a high degree of practical application

Process/Skill Questions

<b>DUTY D:</b> <b>Calculate and measure electrical power</b>
<b>Task:</b>
<b>D001: Determine aircraft electrical power requirements</b>
<p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• Student must be able to demonstrate knowledge of general principles and determine, with a high degree of practical application, the power requirement of individual aircraft components</li> <li>• Student must be able to demonstrate knowledge of general principles and determine, with a high degree of practical application, the power requirements of combined aircraft electrical loads</li> </ul> <p>Process/Skill Questions</p>
<b>DUTY E:</b> <b>Read and interpret aircraft electrical circuit diagrams, including solid state devices and logic functions</b>
<b>Task:</b>
<b>E001: Identify commonly used aircraft electrical and electronic symbols</b>
<p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• Student must be able to demonstrate knowledge of general principles and read and interpret, with a high degree of practical application, aircraft electrical circuit diagrams, including solid state devices</li> <li>• Student must be able to demonstrate knowledge of general principles and read and interpret, with a high degree of practical application, aircraft electrical circuit diagrams, including logic functions</li> </ul> <p>Process/Skill Questions</p>
<b>E002: Read and interpret circuits with aircraft wiring diagrams</b>
<p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• Student must be able to demonstrate knowledge of general principles and read, with a high degree of practical application, circuits with aircraft wiring diagrams</li> <li>• Student must be able to demonstrate knowledge of general principles and interpret, with a high degree of practical application, circuits with aircraft wiring diagrams</li> </ul> <p>Process/Skill Questions</p>
<b>E003: Interpret electronic symbols and schematics in aircraft use, including solid state devices and logic functions</b>
<p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• Student must be able to demonstrate knowledge of general principles and read and interpret, with a high degree of practical application, electronic symbols and schematics</li> </ul>

in aircraft use, including solid state devices

- Student must be able to demonstrate knowledge of general principles and read and interpret, with a high degree of practical application, electronic symbols and schematics in aircraft use, including logic functions

Process/Skill Questions

**E004: Identify electrical malfunctions by reference to circuit diagrams**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and identify, with a high degree of practical application, electrical malfunctions with the use of circuit diagrams
- Student must be able to demonstrate knowledge of general principles and identify, with a high degree of practical application, electrical malfunctions and show location on circuit diagrams

Process/Skill Questions

**DUTY F:  
Inspect and service batteries**

**Task:**

**F001: Understand principles of battery construction and operation**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and inspect batteries with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and service batteries with a high degree of practical application

Process/Skill Questions

**F002: Identify characteristics of aircraft storage batteries**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and identify characteristics of aircraft lead-acid storage batteries with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and identify characteristics of aircraft nickel-cadmium storage batteries with a high degree of practical application

Process/Skill Questions

**F003: Inspect and recharge aircraft storage batteries**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and inspect aircraft storage batteries with a high degree of practical application

- Student must be able to demonstrate knowledge of general principles and recharge aircraft storage batteries with a high degree of practical application

Process/Skill Questions

**F004: Perform removal, installation, and compartment maintenance of aircraft batteries**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and remove aircraft batteries with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and install aircraft batteries with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and perform compartment maintenance of aircraft batteries with a high degree of practical application

Process/Skill Questions

***FLUID LINES AND FITTINGS***

**DUTY A:**

**Fabricate and install rigid and flexible fluid lines and fittings**

**Task:**

**A001: Bend aluminum and stainless steel tubing**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and fabricate aluminum fluid lines and fittings with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and install stainless steel fluid lines and fittings with a high degree of practical application

Process/Skill Questions

**A002: Perform beading of tubing**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and perform beading of tubing with a high degree of practical application
- Student should be able to explain the purpose of beading tubing

Process/Skill Questions

**A003: Fabricate flares on tubing**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and fabricate flares on tubing with a high degree of practical application
- Student should be able to identify an acceptable flare on tubing

Process/Skill Questions

**A004: Fabricate and install flexible hoses**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and fabricate flexible hoses with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and install flexible hoses with a high degree of practical application

Process/Skill Questions

**A005: Recognize defects in metal tubing**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and recognize defects in metal tubing with a high degree of practical application
- Students should be able to reference damage limitations in metal tubing

Process/Skill Questions

**A006: Install a section of tubing**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and install a section of rigid tubing with a high degree of practical application
- Student should be able to discuss factors noted on properly installed tubing sections

Process/Skill Questions

***MATERIALS AND PROCESSES***

**DUTY A:  
Perform precision measurements**

**Task:**

**A001: Inspect aircraft components for wear**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and inspect, with a high degree of practical application, external dimensions for wear with precision instruments
- Student must be able to demonstrate knowledge of general principles and inspect, with a high degree of practical application, internal dimensions with precision measurements
- Student must be able to demonstrate knowledge of general principles and inspect, with a high degree of practical application, dimensions of runout with a dial indicator
- Student must be able to demonstrate knowledge of general principles and inspect clearances with use of feeler gauges with a high degree of practical application

Process/Skill Questions

<p><b>DUTY B:</b>  <b>Identify and select aircraft hardware and materials</b></p>
<p><b>Task:</b></p>
<p><b>B001: Identify and install aircraft bolts</b></p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• Student must be able to demonstrate knowledge of general principles and identify aircraft bolts with a high degree of practical application</li> <li>• Student must be able to demonstrate knowledge of general principles and install, with a high degree of practical application, aircraft bolts regarding proper orientation and use of accompanying lock and or flat washers</li> </ul> <p>Process/Skill Questions</p>
<p><b>B002: Identify aluminum alloys</b></p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• Student must be able to demonstrate knowledge of general principles and manipulative skills to identify aluminum alloys</li> <li>• Students should be able to reference various aluminum alloy properties</li> </ul> <p>Process/Skill Questions</p>
<p><b>B003: Identify steel alloys</b></p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• Student must be able to demonstrate knowledge of general principles and manipulative skills to identify steel alloys</li> <li>• Student should be able to reference various steel alloy properties</li> </ul> <p>Process/Skill Questions</p>
<p><b>B004: Recognize economic and engineering criteria in selection of aircraft materials</b></p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• Student must be able to demonstrate knowledge of general principles and manipulative skills to recognize economic criteria in the selection of aircraft materials</li> <li>• Student must be able to demonstrate knowledge of general principles and manipulative skills to recognize engineering criteria in the selection of aircraft materials</li> </ul> <p>Process/Skill Questions</p>
<p><b>B005: Identify rivets by physical characteristics</b></p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• Student must be able to demonstrate knowledge of general principles and manipulative skills to identify rivets by physical characteristics of standard markings for alloy</li> <li>• Student must be able to demonstrate knowledge of general principles and manipulative skills to identify rivets by physical characteristics of dimensions or size</li> </ul> <p>Process/Skill Questions</p>

**B006: Identify materials used in aircraft firewalls and exhaust shrouds**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to identify materials used in aircraft firewalls and the reason for such
- Student must be able to demonstrate knowledge of general principles and manipulative skills to identify materials used in exhaust shrouds and the reason for such

Process/Skill Questions

**B007: Determine suitability of materials for aircraft repairs**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to determine suitability of materials for aircraft repairs
- Students should be able to reference sources to determine suitable materials for aircraft repairs

Process/Skill Questions

**B008: Identify aircraft control cable**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to identify aircraft control cables with regard to size and strands
- Student must be able to demonstrate knowledge of general principles and manipulative skills to identify aircraft control cables with regard to material used

Process/Skill Questions

**DUTY C:  
Perform basic heat-treating processes**

**Task:**

**C001: Identify effects of heat treatment**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles of performing basic heat-treating processes.
- Student must be able to demonstrate knowledge of general principles of identifying the effects of heat treatment.

Process/Skill Questions

**C002: Identify aluminum alloy code designation of heat treatability**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles of identifying aluminum alloy code designation of process of heat treatment used
- Student must be able to demonstrate knowledge of general principles of identifying

aluminum alloy code designation to determine heat treatability

Process/Skill Questions

**C003: Identify heat-treatment processes and strain relieving**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles of identifying heat-treatment processes
- Student must be able to demonstrate knowledge of general principles of identifying strain-relieving processes

Process/Skill Questions

**C004: Anneal copper and steel parts**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles of annealing copper parts
- Student must be able to demonstrate knowledge of general principles of annealing steel parts

Process/Skill Questions

**DUTY D:  
Perform dye penetrant, eddy current, ultrasonic, and magnetic particle inspection**

**Task:**

**D001: Perform dye penetrant, eddy current, and ultrasonic inspections**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to perform dye penetrant inspections
- Student must be able to demonstrate knowledge of general principles and manipulative skills to perform eddy current inspections
- Student must be able to demonstrate knowledge of general principles and manipulative skills to perform ultrasonic inspections

Process/Skill Questions

**D002: Perform magnetic particle inspections**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to perform magnetic particle inspections
- Student must be able to define *magnetic particle inspection*

Process/Skill Questions

**D003: Perform inspections of welded assemblies**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to perform inspections of welded assemblies
- Students should be able to define qualities of an acceptable weld on aircraft structures

Process/Skill Questions

**D004: Perform tests to distinguish between heat-treatable and weldable aluminum alloys**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles of testing to determine heat treatability of aluminum alloys
- Student must be able to demonstrate knowledge of general principles of testing to determine weldability of aluminum alloys

Process/Skill Questions

**DUTY E:  
Inspect and check welds**

**Task:**

**E001: Inspect and evaluate welds**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and inspect welds with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and evaluate welds for airworthiness with a high degree of practical application

Process/Skill Questions

**DUTY F:  
Identify and select appropriate nondestructive testing methods**

**Task:**

**F001: Identify aircraft uses for nondestructive testing**

*Definition:* Process should include the following:

- Student must be able to discuss uses of nondestructive testing methods
- Student must be able to demonstrate knowledge of general principles of selecting appropriate nondestructive testing methods

Process/Skill Questions

**F002: Discuss eddy current inspections**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles of identifying

- appropriate eddy current inspection methods
- Students should be able to define *eddy current testing*

Process/Skill Questions

***CLEANING AND CORROSION CONTROL***

**DUTY A:  
Identify ABND select cleaning materials**

**Task:**

**A001: Identify caustic materials**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and identify acceptable cleaning materials with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and select proper cleaning materials with a high degree of practical application

Process/Skill Questions

**A002: Identify cleaning agents for aircraft engine parts**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and identify cleaning agents for steel aircraft engine parts with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and identify cleaning agents for aluminum aircraft engine parts with a high degree of practical application

Process/Skill Questions

**DUTY B:  
Inspect, identify, remove, and treat aircraft corrosion, and perform aircraft cleaning**

**Task:**

**B001: Inspect and clean exterior of aircraft**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and inspect exterior of aircraft with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and clean exterior of aircraft with a high degree of practical application

Process/Skill Questions

**B002: Identify corrosion**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and inspect aircraft corrosion and perform aircraft cleaning with a high degree of practical application

- Student must be able to demonstrate knowledge of general principles and identify aircraft corrosion and perform aircraft cleaning with a high degree of practical application

Process/Skill Questions

**B003: Remove corrosion**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and remove aircraft corrosion with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and evaluate acceptable corrosion damage with a high degree of practical application

Process/Skill Questions

**B004: Apply protective coatings**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and treat aircraft corrosion and perform aircraft cleaning with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and apply protective coatings to inhibit corrosion with a high degree of practical application

Process/Skill Questions

**B005: Remove rust**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and remove rust with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and evaluate acceptability of rust damage with a high degree of practical application

Process/Skill Questions

**B006: Clean rubber products**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and properly select cleaning materials for rubber parts with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and properly clean rubber parts with a high degree of practical application

Process/Skill Question

## ***GROUND OPERATION AND SERVICING***

### **DUTY A: Identify and select fuels**

#### **Task:**

#### **A001: Identify aircraft fuels**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to identify aircraft fuels
- Student must be able to demonstrate knowledge of general principles and manipulative skills to select aircraft fuels

Process/Skill Questions

### **DUTY B: Start, ground operate, move, service, and secure aircraft, and identify typical ground operation hazards**

#### **Task:**

#### **B001: Start and operate aircraft engines**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to start aircraft
- Student must be able to demonstrate knowledge of general principles and manipulative skills to perform basic ground operation of aircraft
- Student must be able to demonstrate knowledge of general principles and manipulative skills to perform basic moving of aircraft

Process/Skill Questions

#### **B002: React to fire in induction system**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to extinguish fire in the induction system
- Student must be able to demonstrate knowledge of general principles and manipulative skills to select extinguishing agents for aircraft fire extinguishing

Process/Skill Questions

#### **B003: Direct the movement of aircraft, and identify typical ground operation hazards**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to direct the movement of aircraft on and around the ramp area
- Student must be able to demonstrate knowledge of general principles and manipulative

skills to identify typical ground operation hazards

Process/Skill Questions

**B004: Prepare an aircraft for outside storage**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and manipulative skills to prepare an aircraft for outside storage
- Student must be able to demonstrate knowledge of general principles and manipulative skills to restore an aircraft from outside storage to service

Process/Skill Questions

***MAINTENANCE PUBLICATIONS***

**DUTY A:**

**Demonstrate ability to read, comprehend, and apply information contained in FAA and manufacturer's aircraft maintenance specifications, data sheets, manuals, publications, and related federal aviation regulations, airworthiness directives, and advisory material**

**Task:**

**A001: Locate reference data**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and read and interpret information contained in manufacturer's aircraft maintenance specifications, type certificate data sheets, manuals, and related publications with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and read and interpret information contained in federal aviations regulations, airworthiness directives, and advisory circular material with a high degree of practical application

Process/Skill Questions

**A002: Use information from aircraft specifications**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of how to reference operating limitations of type certificated aircraft
- Student must be able to reference weight and balance limitations by referencing appropriate publications

Process/Skill Questions

**A003: Use information from the manufacturer's manuals to verify control surface travel**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and use of manufacturer's specifications for control surface travel with a high degree of practical application

- Students must show ability to find specifications for specific aircraft regarding control surface movement specifications

Process/Skill Questions

**A004: Identify and relate regulations governing airworthiness certificates**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and identify, with a high degree of practical application, regulations governing airworthiness certificates
- Student must be able to demonstrate knowledge of general principles and relate, with a high degree of practical application, information regarding regulations governing airworthiness certificates

Process/Skill Questions

**A005: Select and use technical standard orders**

*Definition:* Process should include the following:

- Student must be able to define technical standard orders (TSOs)
- Student must be able to demonstrate knowledge of general principles and use technical standard orders with a high degree of practical application

Process/Skill Questions

**A006: Use manufacturer's manuals and other publications**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and perform time efficient usage of manufacturer's manuals with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and perform usage and suitability of other publications with a high degree of practical application

Process/Skill Questions

**A007: Select and use supplementary type certificates, airworthiness directives, and advisory materials**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and select supplementary type certificates, airworthiness directives, and advisory materials as needed with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and use supplementary type certificates, airworthiness directives, and advisory materials as needed with a high degree of practical application

Process/Skill Questions

**DUTY B:  
Read technical data**

**Task:**

**B001: Read, understand, and relate technical information**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and read technical information with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and understand technical information with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and relate technical information with a high degree of practical application

Process/Skill Questions

***MECHANIC PRIVILEGES AND LIMITATIONS***

**DUTY A:  
Exercise mechanic privileges within the limitations prescribed by FAR 65**

**Task:**

**A001: Interpret FAR 65**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of mechanic privileges as prescribed by Title 14 CFR Part 65
- Student must be able to demonstrate knowledge of mechanic limitations as prescribed by Title 14 CFR Part 65

Process/Skill Questions

**A002: Classify aircraft repairs**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and classify major aircraft repairs with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and classify minor aircraft repairs with a high degree of practical application

Process/Skill Questions

**A003: Interpret regulations governing repairs and alterations**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and interpret regulations governing repairs with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and interpret regulations governing alterations with a high degree of practical application

Process/Skill Questions

**A004: Interpret repair station regulations**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and demonstrate knowledge of where to find repair station regulations with a high degree of practical application
- Student must be able to discuss the process that repair stations follow to govern policies and procedures of operation

Process/Skill Questions

**A005: Recognize legal and ethical responsibilities**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and recognize legal responsibilities as an aviation maintenance technician with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and recognize ethical responsibilities of the aviation maintenance technician with a high degree of practical application

Process/Skill Questions

***MAINTENANCE FORMS AND RECORDS***

**DUTY A:**

**Write a description of work performed, including aircraft discrepancies and corrective action, using typical aircraft maintenance records**

**Task:**

**A001: Inspect an aircraft, and prepare a condition report**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and write descriptions of inspections performed, including aircraft discrepancies, using typical aircraft maintenance records with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and write descriptions of inspections performed, including corrective actions, using typical aircraft maintenance records with a high degree of practical application

Process/Skill Questions

**A002: Write a description of major/minor repairs and routine maintenance**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and properly document major repairs with a high degree of practical application
- Student must be able to demonstrate knowledge of general principles and properly document minor repairs and routine maintenance with a high degree of practical application

Process/Skill Questions

<b>DUTY B:</b> <b>Complete required maintenance forms, records, and inspection reports</b>
<b>Task:</b>
<b>B001: Make maintenance record entries</b>  <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> <li>• Student must be able to demonstrate knowledge of general principles and make typical maintenance record entries with a high degree of practical application</li> <li>• Student must be able to demonstrate knowledge of general principles and complete required maintenance forms related to repairs and/or alterations with a high degree of practical application</li> </ul> Process/Skill Questions
<b>B002: Use inspection guides</b>  <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> <li>• Student must be able to demonstrate knowledge of general principles and use manufacturer’s inspection guides with a high degree of practical application</li> <li>• Student must be able to demonstrate knowledge of general principles and use Title 14 CFR Part 43 Appendix C scope and detail inspection guide with a high degree of practical application</li> </ul> Process/Skill Questions
<b>B003: Evaluate aircraft records for compliance with Federal Air Regulations</b>  <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> <li>• Student must be able to demonstrate knowledge of general principles and identify items of concern in an aircraft’s maintenance records with a high degree of practical application</li> <li>• Student must be able to demonstrate knowledge of general principles and evaluate aircraft records for compliance with Federal Air Regulations with a high degree of practical application</li> </ul> Process/Skill Questions
<b><i>WEIGHT AND BALANCE</i></b>
<b>DUTY A:</b> <b>Weigh aircraft</b>
<b>Task:</b>
<b>A001: Locate, interpret, and apply weight and balance information</b>  <i>Definition:</i> Process should include the following: <ul style="list-style-type: none"> <li>• Student must be able to demonstrate knowledge of general principles and manipulative skills to locate, interpret, and apply weight information with regards to maximums</li> <li>• Student must be able to demonstrate knowledge of general principles and manipulative</li> </ul>

skills to locate, interpret, and apply balance information with regard to CG range limitations

Process/Skill Questions

**DUTY B:  
Perform complete weight and balance check, and record data**

**Task:**

**B001: Solve weight and balance problems**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and solve, with a high degree of practical application, weight and balance problems regarding addition of weight
- Student must be able to demonstrate knowledge of general principles and solve, with a high degree of practical application, weight and balance problems regarding subtraction of weight

Process/Skill Questions

**B002: Compute forward and after loaded center of gravity**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and compute, with a high degree of practical application, extreme forward loaded center of gravity
- Student must be able to demonstrate knowledge of general principles and compute, with a high degree of practical application, extreme aft loaded center of gravity

Process/Skill Questions

**B003: Compute effect of equipment changes and loading schedules**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and compute, with a high degree of practical application, effect of equipment changes
- Student must be able to demonstrate knowledge of general principles and compute, with a high degree of practical application, effect of loading schedules

Process/Skill Questions

**B004: Compute weight and balance on a helicopter**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of general principles and compute, with a high degree of practical application, weight on a helicopter
- Student must be able to demonstrate knowledge of general principles and compute, with a high degree of practical application, balance—both fore and aft as well as right and left—on a helicopter

Process/Skill Questions

**B005: Examine weight and balance records**

*Definition:* Process should include the following:

- Student must be able to demonstrate knowledge of where to find weight and balance records for a particular aircraft
- Student must be able to demonstrate knowledge of general principles and examine, with a high degree of practical application, weight and balance records for proper content

Process/Skill Questions

# SkillsUSA

## Task Definitions

<p><b>DUTY A:</b> <b>Self-improvement</b></p>
<p><b>Task:</b></p>
<p><b>A001: Complete a self-assessment, and identify individual learning styles</b></p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• Identify and list individual strengths</li> <li>• Identify and list areas in need of improvement</li> </ul> <p>Process/Skill Questions</p>
<p><b>A002: Discover self-motivation techniques, and establish short-term goals</b></p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• Develop a list of short-term goals</li> <li>• Discuss ways to change or improve lifestyle, appearance, and behavior</li> </ul> <p>Process/Skill Questions</p>
<p><b>A003: Determine individual time-management skills</b></p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• Prepare and keep a time journal</li> <li>• Discuss ways to improve time-management skills</li> </ul> <p>Process/Skill Questions</p>
<p><b>A004: Define future occupations</b></p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• Search the Internet for career opportunities within specified fields of study</li> <li>• Prepare a presentation on a specified career area</li> </ul> <p>Process/Skill Questions</p>
<p><b>A005: Develop awareness of cultural diversity and equity issues</b></p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> <li>• Research a tradition modeled by individual's family</li> <li>• Develop personal philosophy statements regarding gender equity</li> </ul> <p>Process/Skill Questions</p>

**A006: Define the customer**

*Definition:* Process should include the following:

- Differentiate between external and internal customers
- Discuss factors that contribute to poor customer relationships

Process/Skill Questions

**A007: Recognize benefits of doing a community service project**

*Definition:* Process should include the following:

- Discuss and list ways to become involved in the community
- Develop a community service project

Process/Skill Questions

**A008: Demonstrate effective communication with others**

*Definition:* Process should include the following:

- Identify and list personal barriers to listening
- Develop personal plan to overcome barriers to listening

Process/Skill Questions

**A009: Participate in a shadowing activity**

*Definition:* Process should include the following:

- Summarize experience of job-shadowing activity

Process/Skill Questions

**A010: Identify the components of an employment portfolio**

*Definition:* Process should include the following:

- Identify parts of a portfolio
- Design a personal employment portfolio

Process/Skill Questions

**A011: List proficiency in program competencies**

*Definition:* Process should include the following:

- Complete an interpersonal competency assessment

Process/Skill Questions

**DUTY B:**  
**Civic, Social, and Business Awareness**

**Task:**

**B001: Measure/Modify short-term goals**

*Definition:* Process should include the following:

- Discuss steps to pursue short-term goal(s)

Process/Skill Questions

**B002: Identify stress sources**

*Definition:* Process should include the following:

- List personal sources of stress
- Discuss techniques to cope with individual sources of stress

Process/Skill Questions

**B003: Select characteristics of a positive image**

*Definition:* Process should include the following:

- Discuss actions and traits that lead to a positive image
- Discuss actions and traits that lead to a negative image

Process/Skill Questions

**B004: Demonstrate awareness of government, professional organizations, and trade unions**

*Definition:* Process should include the following:

- Identify state governor, legislators, and senators
- Identify professional organizations pertaining to specific career areas

Process/Skill Questions

**B005: Apply team skills to a group project**

*Definition:* Process should include the following:

- Form a team to develop a class project

Process/Skill Questions

**B006: Observe and critique a meeting**

*Definition:* Process should include the following:

- Attend a formal meeting held within the community
- Critique the attended meeting

Process/Skill Questions

**B007: Demonstrate business meeting skills**

*Definition:* Process should include the following:

- List and discuss the basic rules to ensure an orderly and businesslike meeting
- Role-play appropriate meeting skills

Process/Skill Questions

**B008: Demonstrate social etiquette**

*Definition:* Process should include the following:

- Role-play appropriate social behavior
- Differentiate between good and bad manners

Process/Skill Questions

**B009: Complete survey for employment opportunities**

*Definition:* Process should include the following:

- Gather information on a particular employment opportunity of interest
- Conduct an Internet search of a specific career area

Process/Skill Questions

**B010: Review a professional journal and develop a 3- to 5-minute presentation**

*Definition:* Process should include the following:

- Develop a presentation on the content, purpose, and distribution of a particular professional journal

Process/Skill Questions

**B011: Identify customer expectations**

*Definition:* Process should include the following:

- List and discuss customer expectations
- Discuss consequences of unmet customer expectations

Process/Skill Questions

**B012: Complete a job application**

*Definition:* Process should include the following:

- Obtain a job application from various businesses in the community
- Conduct a mock job interview

Process/Skill Questions

**B013: Identify a mentor**

*Definition:* Process should include the following:

- Define *mentor*
- Discuss ways in which a mentor can help an individual meet career goals

Process/Skill Questions

**B014: Assemble your employment portfolio**

*Definition:* Process should include the following:

- Develop employment portfolio

Process/Skill Questions

**B015: Explore supervisory and management roles in an organization**

*Definition:* Process should include the following:

- Examine an organizational chart
- Discuss responsibilities of managers and supervisors

Process/Skill Questions

**B016: Recognize safety issues**

*Definition:* Process should include the following:

- Discuss safety issues within a given career area

Process/Skill Questions

**B017: Evaluate your proficiency in program competencies**

*Definition:* Process should include the following:

- Define *task* and *competency*
- List competencies associated with a specified career area

Process/Skill Questions

# Curriculum Frameworks

## Purpose

This section of the framework contains material to help instructors in technical and professional programs reinforce basic skills in the areas of reading and writing, mathematics, and science. The technical portion of this guide takes a more direct approach by using specific duty and task listings, but changes in the academic section lead in a more general direction. The reason for this is simple: All good instructors do not teach in the same way. However, all good instructors share the trait of being able to connect their material to everyday life. For example, understanding concepts related to heat is important for cosmetology students as well as lathe operators in manufacturing plants. However, each program will probably take a different approach in the amount of detail and examples relating to heat concepts. Both groups require basic science knowledge of principles relating to heat, but the application of the principles will be different.

## Basic Skills: The Content Areas

Included in this guide are materials to support basic skills in reading and writing, mathematics, and science. The overall approach taken here is a move toward problem-solving skills. By problem solving, we mean the ability to take information and use it for a purpose: to take action, make decisions, predict outcomes, suggest improvements. Another term for these thinking skills is a general “literacy.”

Literacy skills always have been in demand in the workplace. A quick review of workplace training programs and other literature regarding adult education demonstrates that the need for a literate workforce is still one of the most pressing problems employers face today. Indeed, many employers (from small- and medium-sized businesses to Fortune 500 companies) have spent hundreds of millions of dollars on in-house basic skills training programs.

What constitutes a literate workforce? There are many definitions for literacy and hundreds of tests that measure it, but when employers are asked what they’re looking for in potential new hires, the answers are general: They want individuals who can read and write; show up on time;

think and solve problems; and keep their personal lives in order (that is, don't bring a drinking problem into the workplace).

Viewed in this way, the words “literacy” and “literate” are good terms for what educators are trying to instill in their students, the future workforce. The more common definition (being able to read and write) is certainly appropriate, but the additional definitions (knowledgeable, educated, and well-informed) are also apt. It is this broad term, “literate,” that we use to guide instructors on what to cover in the classroom. No matter which Career and Technical Education area is being focused on, no matter how technical the terminology is, instructors are given the task of helping students take information, break it down into necessary parts, process details, and be able to come away with an understanding of some sort. This is “literacy,” and the process is the same for every subject area—teaching students how to think and solve problems.

## Format

Each section includes a two-column table. Skills are listed on the left side; suggestions for implementing these skills into the curriculum are listed on the right side. Each suggestion is written in such a way that it can be tailored to most Career and Technical Education programs.

## Using the Guide

This guide was prepared with four concepts in mind:

- The instructor is *aware of the need* for students to improve their basic skills.
- The instructor is the *best-qualified person* to decide how to include this material in the classroom or lab. The students' abilities and needs should drive the instructor in deciding how to use, expand, or modify these topics.
- The instructor *already has curriculum that works* for his or her students. Therefore, the suggestions for reinforcing basic skills
  - must be easy to implement.
  - must stand alone.
  - do not need to be taught in a particular order.
  - must be open-ended enough to be useful for any career and technical program.

- ***Time is limited.*** Unless there are quick ways to reinforce basic skills, changes to the curriculum will not be made. Teaching basic skills in the context of technical material will help students make connections that are more memorable and will require no additional lesson planning. Just as instructors incorporate updates in technical knowledge, they can add basic skills concepts as well. Adding a few concepts at a time will help students perform better in the lab as well as on tests and evaluations.

## Methods

The following methods may help instructors decide how to increase basic skill knowledge:

- *Collaborative projects*—how could a joint project between regular education teachers and vocational instructors reinforce concepts for both programs?
- *Outside assignments*—would students benefit from an outside assignment explaining how a basic math (science, reading) concept ties to a process in the lab?
- *Extra credit*—students needing extra credit can research outside topics and turn in a short summary of material.
- “*Need-to-know*” *assignments*—students prepare a bulleted list of the basic concepts in science they need to know to correctly perform operations in the lab.
- *Question of the day*—a few daily math problems for students to answer at the beginning of class allow the instructor to set the tone for the material. This method also gives students an immediate goal when they enter the classroom and teaches them to stay on task. Bonus points may be awarded at the end of the week, quarter, semester, etc.
- *Two-minute oral presentations*—students who need to practice speaking skills can be asked to give a two-minute oral presentation at the end of class summarizing the main points for the day. Or, a two-minute presentation at the beginning of class can recap the material from a previous class.
- *Connecting with workers*—students can poll parents, friends, area employers, or other people to find out the top five basic science skills needed on the job.
- *Direct questioning*—include a few basic knowledge questions in a presentation. Award points to groups based on correct answers.

## Resources

In creating the Academic Reinforcement material for the technical and professional frameworks, we used a number of source documents and resources.

- The English Language Arts, Science, and Mathematics components of the *Curriculum Improvement Project* by Dr. Willard Daggett were consulted to ensure that the top-ranked skills in those areas would be reflected in the academic support material. The English Language Arts and Science components have many linkages to the material included here. (The higher-level math skills, such as trigonometry, were not included in this document.)
- The Workplace Skills Enhancement Program (WSEP) at the University of Arkansas at Little Rock (UALR) has completed many training projects and job profiles for employers in Arkansas and has collected data from this work with Arkansas employers. Our constant contact with workers and employers provides a tremendous amount of data that we use in designing customized training programs and in working on projects such as curriculum frameworks. Also, the staff of WSEP has experience teaching in Arkansas public schools, the U.S. military, and Job Corps.
- Additionally, other groups within UALR (the Labor Education Program, the Institute for Economic Advancement, and the College of Business) provide resources regarding health and safety information, labor unions and their role in the workplace, computer and information technology, and other training and outreach program data.
- The U.S. Department of Labor (DOL) has many online documents and publications that support workers and issues regarding the workplace. (Work by Philippi and Greenan, 1988, on workplace skills was especially helpful.) Visit the Web site at [www.dol.gov](http://www.dol.gov).
- The Occupational Safety and Health Administration (OSHA) provides online and other resources for instructors and professionals. For topics relating to safety and health, visit [www.osha.gov](http://www.osha.gov).
- The Multistate Academic and Vocational Curriculum Consortium (MAVCC) is an organization that develops competency-based curriculum. For more on MAVCC, see [www.mavcc.org](http://www.mavcc.org).

# ACADEMIC STANDARDS FOR READING AND WRITING

## Strategies for Reinforcement in the Career and Technical Education Classroom

**Note:**

\* indicates industry-related materials, handouts, notes, etc.

Objective	Classroom Applications to Industry
<p><i>Present</i> <i>Review, and discuss</i> <b>Master the list of skills employers want for the workplace regarding reading and writing</b></p>	<p>Use the list of skills employers want to introduce students to the requirements of the workplace.</p> <p>Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts:</p> <ul style="list-style-type: none"> <li>• Discussion</li> <li>• Interviewing parents or other adults in the workplace about the skills required</li> <li>• Interviewing employers about the skills in terms of importance</li> <li>• Identifying workplace situations in which certain skills become more important than others</li> <li>• Researching adult education programs to learn why deficits in these areas must be remediated and the cost spent yearly on these programs</li> <li>• Researching the topic of adult literacy</li> </ul>
<p><i>Answer</i> <b>simple comprehension or recall questions from a lecture or from written material</b></p>	<p>Provide two examples of workplace materials* on students' reading level. With the first, allow students to read information and then answer brief recall questions. With the second example, read aloud the material but do not give a handout. Ask brief recall questions.</p> <p>Compare the differences. How do students retain information better—orally or visually? Discuss learning styles and impact on the job.</p>

<i>Follow, give</i> <b>oral instructions</b>	Using instructions for a hands-on task, have students give <u>oral</u> instructions to a partner or group. Rate the effectiveness of the speaker.
<i>Follow, give</i> <b>written instructions</b>	Using a short list of instructions for a hands-on task, have students give <u>written</u> instructions to a partner or group. Rate the effectiveness of the speaker.
<i>Show the difference between relevant and irrelevant details</i>	Using a copy of workplace materials*, students underline relevant or important details in red, irrelevant or less important details in blue.
<i>Sort objects based on x number of criteria</i>	Using workplace materials*, sort a group of objects based on characteristics identified by instructor (e.g., by color, shape, defect, or a combination of these).
<i>Recognize, identify</i> <b>technical vocabulary</b>	Using workplace materials*, highlight technical vocabulary terms.  Create a class dictionary of industry-related technical vocabulary. Students may add illustrations or diagrams. Each student receives a copy of the final product. Emphasize skills such as alphabetical order, guidewords, prefixes, suffixes, and pronunciation guides.
<i>Read aloud</i>	Read aloud from workplace materials* in groups or individually.
<i>Identify, explain</i> <b>symbols, abbreviations, and acronyms relevant to subject area</b>	Using workplace materials*, highlight symbols, abbreviations, and acronyms.  Create a table with one column for each: symbols, abbreviations, acronyms. Classify each one and write in the meaning.
<i>Understand, use</i> <b>rules of grammar, usage, spelling, punctuation</b>	Identify the missing punctuation marks, misspelled words, and incorrect use of grammar from workplace materials*.  Correct the mistakes.

<i>Discuss</i> <b>uses and purposes of a variety of workplace communication tools</b>	Find examples of a business letter, memo, report, brochure, proposal, schematic, map, and diagram.
<i>Duplicate</i> <b>process demo by instructor</b>	Using a workplace process, demonstrate steps to complete and have students perform individually or in groups.
<i>Notice, apply</i> <b>word analysis techniques</b>	Using workplace materials*, identify prefixes, suffixes, or roots that indicate meaning (e.g., therma = heat). <sup>1</sup>
<i>Match</i> <b>parts from photographs or diagrams to actual objects</b>	Using workplace materials*, follow a sequence of pictures or diagrams to build, create, or copy an item or process.
<i>Read</i> <b>for main ideas and details</b>	Use a graphic organizer <sup>1</sup> to show main ideas and supporting details.
<i>Distinguish</i> <b>between fact, opinion, and inference</b>	Collect examples of materials based on fact or opinion/inference. Ask students to underline key terms that indicate the presence of facts or opinions.
<i>Distinguish</i> <b>between rows and columns</b>	Using charts or tables from workplace materials*, discuss the reasons for this format.
<i>Identify</i> <b>a cell as a block where a row and column intersect</b>	Identify the quantity in a particular cell.
<i>Select, use</i> <b>appropriate resources and reference tools</b>	<p>Explain the uses for the following: dictionary, thesaurus, almanac, atlas, card catalog, encyclopedia.</p> <p>List reasons for choosing one reference tool over another.</p> <p>Use reference tools to answer questions related to industry or current events.</p>
<i>Paraphrase</i> <b>written or oral material into summary form</b>	<p>Using workplace materials*, determine the best way to condense or shorten the material so as to give an overview to a layperson.</p> <p>Using a set of guidelines appropriate to</p>

	students' level in length and detail, summarize the information into bullet points.
<i>Interpret, fill out/complete forms and records</i>	Using workplace materials*, answer basic questions (e.g., summarize the list of parts from an inventory).  Using blank forms or documents, fill in details. Pay close attention to directions. Students critique work with a partner.  Create a form or document to be used in a workplace process.
<i>Use, develop a process for remembering details</i>	Use pneumatic devices to organize and remember details. Pneumatic devices <sup>1</sup> include Semantic Maps, Thought Webs, and other creative tools to organize thinking.
<i>Proofread, correct mistakes in written drafts</i>	Using a newspaper article, locate and mark mistakes in grammar, punctuation, or usage.  Correct mistakes in written drafts.
<i>Examine different types of writing used in the workplace (reports, memos, brochures, logs, blueprints, formulas, etc.)</i>	Gather samples of workplace materials*. Identify each by type.  Compare and contrast the difference between: <ul style="list-style-type: none"> <li>• audience (who the document is written for)</li> <li>• length</li> <li>• background information/education needed to understand material</li> <li>• level of detail</li> <li>• organization and layout of the document</li> </ul>
<i>Understand the writing process</i>	In order to apply the writing process, create a workplace communication tool to be used for a specific purpose.  Prewrite: Brainstorm, gather facts, or do research to create a <u>business letter, memo, report,</u>

	<p><u>brochure, proposal, schematic, map, or diagram.</u></p> <p>Identify the audience.</p> <p>Determine the purpose of the document.</p> <p>Write: Create a first draft.</p> <p>Revise and edit: Make changes to ensure accuracy.</p> <p>Look at the writing from a different point of view.</p> <p>Shorten or make more concise where possible.</p> <p>Use white space, bold print, and other formatting details to make the document easy to read.</p> <p>Publish: Decide on the best format for the final copy (size, type of material, layout, graphics, etc.)</p> <p>Publish the final draft.</p>
<p><i>Identify, create</i> <b>sentences of different types</b></p>	<p>Using workplace materials*, find sentences of varying types. Examples include simple sentences (subject + predicate) and complex sentences (subject + predicate including clauses).</p> <p>Write sentences, paragraphs, or essays using sentences of different types (e.g., write a two-paragraph summary of today's lesson).</p>
<p><i>Identify, use</i> <b>contractions correctly</b></p>	<p>Using workplace materials*, locate contractions (e.g., isn't, I'll).</p> <p>Identify misuses of contractions.</p> <p>Write a short list of directions relating to an</p>

	industry process, and use as many contractions as possible.
<i>Identify, use correctly</i> <b>commonly misspelled words</b>	<p>Using a list of commonly misspelled words<sup>1</sup>, locate errors in the media (newspaper articles, Internet sites, magazines).</p> <p>Ask each student to identify his/her problem words from the list.</p> <p>Attempt to incorporate problem words into class activities (e.g., add them to a list of work instructions).</p> <p>Give short weekly quizzes focusing on five words per week. Award bonus points.</p>
<i>Identify, use correctly</i> <b>the English irregular verbs</b>	<p>From a list of irregular verbs, review the uses of each.</p> <p>Ask each student to identify his/her problem irregular verbs from the list.</p> <p>Attempt to incorporate problem verbs into class activities, such as making a collection of mistakes from print sources.</p>
<i>Identify, use</i> <b>signal words and other cues to improve writing</b>	<p>Use a list of signal words<sup>1</sup> and discuss their purpose in writing (signal words are words that raise a flag to a reader to pay attention). Examples --</p> <p>Signal words showing emphasis: Most of all, It should be noted, Of course</p> <p>Signal words showing a conclusion: Lastly, In summary, Finally</p> <p>Identify common signal words in workplace writing, especially in sequenced lists.</p> <p>Write a list of work instructions using signal words.</p>
<i>Identify</i> <b>components of workplace documents such as blueprints,</b>	Label the parts of a workplace document.

<b>schematics, floor plans, and other industry-related documents</b>	
<i>Place steps in proper sequence</i>	Using a list of steps or pictures, cut them apart so students can place them in the proper order.
<i>Analyze cause and effect</i>	Experiment with cause and effect in the classroom (e.g., change the sequence of events in a process).
<i>Determine missing information</i>	<p>Locate the information that is missing from a problem, and explain why the problem cannot be solved without it.</p> <p>To reinforce concepts, use a completed problem and remove the important details. Ask students if they can identify what's missing.</p>
<i>Differentiate between tools used for a job</i>	Given a list of tools and a list of functions, identify the most efficient tool for each task.
<i>Assemble or disassemble objects</i>	<p>From a list of oral or written instructions, assemble an object or complete a process.</p> <p>Have students write the instructions for disassembly.</p>
<i>Cross-reference materials to compare information</i>	Using more than one source document, compare the information given.
<i>Interpret reasoning behind rules or regulations</i>	Using workplace materials*, make a list of possible reasons or justifications for a safety guideline, regulation, etc.
<i>Show contrasts between approaches</i>	<p>Given a workplace scenario, write a brief approach to solving the problem. (Working in groups would be beneficial.)</p> <p>Compare and contrast each approach from the perspective of a worker, manager, supervisor.</p>
<i>Organize data in a new format</i>	Using workplace materials*, organize the information into a new format.

<i>Prove a rule or method's sufficiency</i>	Perform an experiment to determine how much tolerance is acceptable in a case study (e.g., find the range of drops of red dye sufficient to match the standard red color used in latex paint).
<i>Show relationships between two or more systems</i>	Using two or more partners related to industry, show or explain how they are interrelated (e.g., explain the relationship between social workers and hospitals).
<b>Given examples of emergency situations, identify a real-world course of action</b>	Using an emergency situation common to your industry, outline a step-by-step plan for action.
<i>Identify variables that affect the outcome of a process</i>	Experiment with or predict variables that affect the outcomes for a process (e.g., weather patterns that adversely affect a process, such as building a road).
<i>Infer situations that meet guidelines when complete information is not available</i>	Given a policy or industry standard that has debatable interpretations, list possible situations that can arise that do not have clear solutions in the policy.  Discuss or debate the issues.
<i>Compare finished products to a set of guidelines</i>	Compare a set of objects to a set of guidelines (e.g., analyze a batch of parts and document how they do or do not meet a set of Quality Assurance guidelines).  List any discrepancies (parts that do not meet guidelines) and categorize them by type (e.g., burns, holes, etc).
<i>Identify preventive measures for maintenance of a system</i>	List the needed routine maintenance to keep a system working properly.
<i>Predict new standards or rules that may become necessary in the future</i>	Identify recent areas of change or development in your industry.  Discuss potential future needs or developments that may occur (e.g., potential need for better training requirements for airport personnel).

<p><b><i>Improve a process by streamlining (locating waste) or decreasing lost time</i></b></p>	<p>Examine a process in industry in step-by-step detail. Suggest ways to decrease time needed or make the process more efficient.</p> <p>Isolate the cause of failure in a process by performing an experiment.</p>
<p><b><i>Prepare a model explaining a concept</i></b></p>	<p>Build, draw, or create a model that explains a concept (e.g., show a need for environmental standards for water or air pollution).</p>

<sup>1</sup> Fry, Edward; Kress, Jacqueline; Fountoukidis, Dona. *Reading Teacher's Book of Lists*, 4<sup>th</sup> ed. ISBN 0-13-028185-9.

# ACADEMIC STANDARDS FOR MATHEMATICS

## Strategies for Reinforcement in the Career and Technical Education Classroom

**Note:**

\* indicates industry-related materials, handouts, notes, etc.

**Topics Listing**

- Problem Solving
- Operations and Calculations
- Applications
- Data Analysis and Display

**Objectives**

**Classroom Applications to Industry**

<p><i>Present</i> <i>Review and discuss</i> <b>Master the list of skills employers want for the workplace regarding mathematics</b></p>	<p>Use the list of skills employers want to introduce students to the requirements of the workplace.</p> <p>Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts:</p> <ul style="list-style-type: none"> <li>• Discussion</li> <li>• Interviewing parents or other adults in the workplace about the skills required</li> <li>• Interviewing employers about the skills in terms of importance</li> <li>• Identifying workplace situations in which certain skills become more important than others</li> <li>• Researching adult education programs to learn why deficits in these areas must be remediated and the cost spent yearly on these programs</li> <li>• Researching the topic of adult literacy</li> </ul>
<b>PROBLEM SOLVING</b>	
<p><i>Examine, apply</i> <b>problem-solving process</b></p>	<p>Define the problem What is being asked?</p> <p>Decide on a type of solution. Multistep or single-step question?</p>

	<p>Try any of these:</p> <ul style="list-style-type: none"> <li>• Estimate an answer</li> <li>• Draw a diagram</li> <li>• Find a pattern</li> <li>• Guess and check</li> <li>• Logical reasoning</li> <li>• Make a graph</li> <li>• Make an organized list</li> <li>• Make a table</li> <li>• Solve a simpler problem</li> <li>• Use a simulation</li> <li>• Work backwards</li> <li>• Write an equation</li> </ul> <p>Locate information you need. Do you have all the components?</p> <p>Get missing information. You may need to perform some other calculations</p> <p>Calculate. Look at the answer. How should the remainder be expressed?</p> <p>Check the solution. Is it reasonable?</p>
<b>OPERATIONS AND CALCULATIONS</b>	
<p><i>Read, write <b>and</b> count numbers</i></p>	<p>Read and write numbers (especially focus on very large and very small numbers where mistakes are common).</p> <p>Give a weekly quiz asking students to compare and sequence numbers. Example: 0.4445 ___ 0.4455 &gt; or &lt;</p> <p>Put these in order from smallest to largest: 0.66, 0.677, 0.67</p>
<p><i>Round numbers</i></p>	<p>Discuss your industry's use of decimals.</p> <p>Identify the place values needed to adequately perform a job. For example, a Quality</p>

	<p>Assurance Technician who works on the line in a manufacturing plant may need to use numbers through the ten-thousandths decimal place.</p> <p>Take a series of sample measurements, and round them to the nearest decimal place identified by the instructor.</p>
<i>Estimate numbers</i>	<p>The skill of making close estimations is tied to understanding accuracy. Discuss real-life situations in which estimation is used.</p> <p>Discuss the practice of estimation before calculation. Regular practice in estimating before calculating will teach students where they make errors and will increase their estimation skills.</p> <p>Discuss work situations in which estimation skills are required and possible consequences of making estimation errors. For example, is an estimate appropriate for inventory purposes? For ordering supplies?</p>
<i>Compute averages</i>	<p>Discuss averages in general terms. Calculate the average temperature, average rainfall or precipitation, average number of students per class, and other relevant examples.</p> <p>Using workplace materials*, calculate a series of averages. For example:</p> <ul style="list-style-type: none"> <li>• Take 10 different measurements of a piece of pipe using a micrometer.</li> <li>• Compare the measurements.</li> <li>• Find the average of all the measurements.</li> <li>• Compare the average to the smallest and largest measurement.</li> <li>• Discuss the effects on quality. When is an average an acceptable benchmark measurement?</li> </ul>
<i>Calculate with whole numbers; perform one-step problems with basic operations</i>	<p>Understand, at a level of complexity appropriate to your industry and to students'</p>

	ability levels, basic principles of addition, subtraction, multiplication, and division.
<b>Perform problems that require an understanding of the order of operations</b>	<p>Using workplace materials*, make a list of situations or problems that need more than one step to perform them.</p> <p>If the procedures (add, subtract, multiply, divide, etc.) are on the same level of importance, such as adding or subtracting, then the order of operations will not impact the way the problem is solved.</p> <p>If a problem requires more than one level of operation to solve (example, dividing and adding), work the problem correctly by performing the division part first and then the addition. Rework the problem using addition first. Compare the answers.</p> <p>Discuss the importance of reasoning skills to verify that an answer makes sense.</p>
<b>Understand the relationship between decimals, fractions, and percentages</b>	Make a table comparing fractions, decimals, and percentages.
<b>Compute with fractions, decimals, and percentages, and show an understanding of the relationship between them</b>	<p>Create sample problems using fractions that relate to everyday situations.</p> <ul style="list-style-type: none"> <li>▪ Poll the class on interesting topics (favorite food). Convert whole numbers to fractions. Votes: <ul style="list-style-type: none"> <li>Pizza- 10</li> <li>Salad- 2</li> <li>BBQ- 8</li> </ul> </li> </ul> <p><math>10+2+8 = 20</math> (recognize denominator value)</p> <p><math>\frac{10}{20}</math> Pizza <math>\frac{2}{20}</math> Salad <math>\frac{8}{20}</math> BBQ</p> <ul style="list-style-type: none"> <li>▪ Add the fractions. <math display="block">\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20}</math> </li> <li>▪ Convert the fractions to a whole number. (Total answer equals one</li> </ul>

	<p>class' worth of answers.)</p> $\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20} = 1$ <ul style="list-style-type: none"> <li>▪ Convert the fractions to percentages.</li> </ul> <p><math>\frac{10}{20}</math> means 10 divided by 20 = 0.50</p> <p>Move the decimal two places to the right. 0.50 = 50%</p> <p><math>\frac{2}{20}</math> means 2 divided by 20 = 0.10</p> <p>0.10 = 10%</p> <p><math>\frac{8}{20}</math> means 8 divided by 20 = 0.40</p> <p>0.40 = 40%</p> <p>50% + 10% + 40% = 100% Notice the totals add to 100%.</p> <p>So, <math>\frac{20}{20} = 1 = 100\%</math></p> <p>Using workplace materials*, calculate work-related questions using fractions, decimals, and percentages.</p> <p>Calculate shipping costs for Internet purchases (such as music from amazon.com).</p>
<b>Solve formulas and equations</b>	<p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of equations.</p> <ul style="list-style-type: none"> <li>▪ Work left to right</li> <li>▪ Use order of operations</li> <li>▪ Place numbers on one side, variables on the other side</li> </ul>
<b>Obtain squares and square roots</b>	<p>Review the methods for calculating squares, square roots, cubes, and cube roots. Use industry-related formulas to demonstrate examples.</p> <p>Compare the difference between the two</p>

	<p>common answers to 32 (answer = 9, not 6).</p> <p>How would an incorrect value affect the work on the job?</p>
<p><i>Convert units of measure:</i> <i>Recognize components of measuring systems (U.S. and metric) for length</i></p>	<p>Discuss industry measures and terms relating to length.</p>
<p><i>Convert units of measure:</i> <i>Recognize components of measuring systems (U.S. and metric) for mass/weight</i></p>	<p>Discuss industry measures and terms relating to mass/weight.</p>
<p><i>Convert units of measure:</i> <i>Recognize components of measuring systems (U.S. and metric) for volume</i></p>	<p>Discuss industry measures and terms relating to volume.</p>
<p><i>Measure with a certain degree of accuracy</i></p>	<p>Estimate measurements.</p> <p>Using workplace materials* and tools, take measurements of work-related and classroom items. Depending on ability level, students may measure to the nearest foot, inch, centimeter, etc.</p>
<p><b>APPLICATIONS</b></p>	
<p><i>Solve word problems</i></p>	<p>Help students feel more comfortable with word problems by placing simpler problems in word problem form; or take concepts students have already mastered and ask them to write word problems for each other to solve.</p>
<p><i>Select/apply mathematical formulas</i></p>	<p>Review a set of math formulas and then a list of sample problems. Decide which formula(s) apply to each problem.</p>
<p><i>Understand the importance of time in the workplace</i></p>	<p>Using workplace materials*, make a list of workplace scenarios that require using time correctly, such as keeping a time card or heating a liquid solution for 20 minutes.</p>
<p><i>Recognize components of time systems (clocks and calendars)</i></p>	<ul style="list-style-type: none"> <li>• a.m. and p.m.</li> <li>• Leap year</li> <li>• Military time</li> </ul>

<p><i>Discuss, identify, understand terms relating to measuring time</i></p>	<p>Discuss the units of time measurement and time vocabulary: second, minute, hour, day, week, month, year, leap year, fiscal year, quarter, annual, biannual, etc.</p>
<p><i>Understand that time can be expressed in terms of equivalencies</i></p>	<p>Show the time equivalencies using fractions. For example:  <math>1 \frac{1}{2}</math> days = ___ hours</p> $\begin{array}{r} 1 \text{ day} = 24 \text{ hours} \\ + \frac{1}{2} \text{ day} = +12 \text{ hours} \\ \hline 1 \frac{1}{2} \text{ days} = 36 \text{ hours} \end{array}$
<p><i>Compute time conversions</i></p>	<p>Make a table that shows the equivalencies of time units.</p> <p>Compute conversion problems at the appropriate level of difficulty. Examples include:</p> <ul style="list-style-type: none"> <li>• Convert minutes to hours</li> <li>• Convert hours to days</li> <li>• Convert seconds to years</li> </ul>
<p><i>Calculate ratio and proportion</i></p>	<p>Review fractions when discussing ratio and proportion.</p> <p>Draw common classroom items to scale by finding a conversion rate (1 foot equals 1 inch).</p> <p>Make predictions using ratios. (If each student in the class has three children, how many children will there be altogether? Write the ratios.)</p>
<p><i>Apply geometry principles: Use formulas for measuring shapes of two dimensions</i></p>	<p>Determine the formulas that apply to two dimensions: perimeter, area, surface area. Find the perimeter of the classroom.</p> <p>Discuss the perimeter of objects that are not shaped as perfect squares. How does this change the formula for perimeter?</p> <p>Find the area of the tiles on the floor. Find the area of the classroom.</p>

	Review that all areas are expressed in terms of square units (square inches, square miles, etc.).
<b><i>Apply geometry principles: Use formulas for measuring shapes of three dimensions</i></b>	Review the formulas that apply to three dimensions of objects: volume. Review that volume is expressed in cubic units.  Find the volume of common objects such as soda cans, pizza boxes, etc.  Discuss industry-specific needs for these formulas. For example, find the volume of a tank or silo.
<b><i>Define terms relating to money</i></b>	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles relating to money.  For more advanced students, include terms and principles of economics, finance, or statistics.
<b><i>Perform one-step problems involving money</i></b>	Make change. (Count up—rather than backwards—to make change.)
<b><i>Perform multiple-step problems using money</i></b>	Calculate gross and net earnings.  Calculate: <ul style="list-style-type: none"> <li>▪ Interest</li> <li>▪ Sales tax</li> <li>▪ Percent off</li> <li>▪ Sale price</li> <li>▪ Profit percentages</li> </ul> Perform banking transactions.
<b><i>Perform business-related financial activities</i></b>	At a level of complexity appropriate to your industry and to students' ability levels, solve income/expense problems, prepare budgets, etc.
<b><i>Use a calculator to perform computations</i></b>	Identify appropriate activities that can be performed using a calculator (calculators

	<p>allow students to concentrate on problem-solving strategies).</p> <p>Award prizes for weekly activities or competitions.</p>
<b>Calculate measurements taken from measuring devices</b>	Add, subtract, multiply, and divide measurement numbers by plugging them into formulas.
<b>Perform/prepare an inventory</b>	<p>Use a sample group of items to prepare an inventory. Discuss the math processes that would apply to the inventory process.</p> <p>Review inventory vocabulary terms.</p>
<b>DATA ANALYSIS AND DISPLAY</b>	
<b>Recognize types of visual representations</b>	<ul style="list-style-type: none"> <li>• Charts</li> <li>• Graphs</li> <li>• Tables</li> </ul>
<b>Interpret charts, graphs, and tables</b>	<p>Answer simple questions about charts, graphs and tables.</p> <p>Solve multistep problems involving the correlation of graphs and tables.</p>
<b>Collect/record data</b>	<p>As appropriate to industry, practice sampling methods. Discuss safety precautions for sampling. Visit OSHA at the Department of Labor Web site for more details.</p> <p>Practice collecting and recording sample data from your industry (such as measurements taken using a micrometer). Compare class answers.</p> <p>Find the range of answers (maximum and minimum). Find the average. Discuss an acceptable range of answers (<math>\pm</math>), and graph the results showing the number that fell inside and outside the acceptable range.</p>
<b>Review and apply principles of probability</b>	Use real-life examples that are highly motivating to direct the students' attention to probability principles. (Example, "I am thinking of a number between 1 and 50. The person who guesses the number will receive

	that many bonus points if s/he can tell me the probability of choosing the number correctly.”)
<b>Use probability models to predict chance events</b>	<p>Calculate <u>theoretical probability</u> of an event (e.g., the probability of rolling a 5 on a die is 1/6).</p> <p>Find <u>empirical probability</u> of an event by performing repeated experiments. Compare the two probabilities.</p>
<b>Calculate and interpret statistics</b>	<p>Identify the importance of using statistics correctly. Bring examples of statistics from the news or media and analyze them: Are they ambiguous? Are they correct? What data is the advertisement trying to get the public to see?</p> <p>For a humorous look at statistics, see <i>How to Lie with Statistics</i> by Huff and Geis.</p>
<b>Interpret plans/blueprints</b>	<p>Review vocabulary and terms for plans, blueprints, and schematics.</p> <p>Build a plan or blueprint one layer at a time, starting with the basic identifying information.</p> <p>Add layers of wax paper or other transparent drawing material on top of the first layer that allows each layer to be viewed individually or the entire drawing as a whole.</p>
<b>Construct charts and tables</b>	<p>Discuss chart types and chart vocabulary.</p> <p>Using workplace or sample data from the class, construct tables and charts. For a daily example, consult <i>USA Today</i> online and look for the snapshots section that shows a graph of some sort. Ask weekly bonus questions about the data.</p> <p>Challenge students to bring in examples of charts and graphs containing errors.</p>

**ACADEMIC STANDARDS FOR SCIENCE**  
Strategies for Reinforcement  
in the Career and Technical Education Classroom

**Note:**

\* indicates industry-related materials, handouts, notes, etc.

**Topics Listing**

**General Science:** Topics not specific to a content area

**Physical Science:** Mechanics and Physics

Energy and Waves

Thermodynamics

Electromagnetism

Chemistry

Optics

**Life Science:** Cell Biology

Evolution

Genetics and Heredity

Human and Animal Development

**Anatomy:** Ecology

Viruses

Bacteria

Plants

**Earth Science:** Earth in Space

Solar System/Astronomy

Atmosphere and Weather

Oceans and Water

Earth Resources

**Objective**

**Classroom Applications to Industry**

<b>GENERAL SCIENCE</b>	
<p><i>Present</i> <i>Review and discuss</i> <b>Master the list of skills employers want for the workplace regarding science skills</b></p>	<p>Use the list of skills employers want to introduce students to the requirements of the workplace.</p> <p>Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts:</p> <ul style="list-style-type: none"> <li>• Discussion</li> <li>• Interviewing parents or other adults in the workplace about the skills required</li> <li>• Interviewing employers about the skills in terms of importance</li> <li>• Identifying workplace situations in which certain skills become more important than others</li> <li>• Researching adult education programs to learn why deficits in these areas must be remediated, and discover the cost to employers to educate adult workers</li> <li>• Researching the topic of adult literacy</li> </ul>
<p><b>Perform computations as required to solve problems</b></p>	<p>Use the metric system to convert units of measure.</p> <p>Round numbers to correct number of significant figures.</p> <p>Determine percentage of error.</p> <p>Understand validity, reliability, accuracy, and precision.</p>
<p><b>Apply scientific method of inquiry</b></p>	<p>Identify the steps of the scientific method.</p> <p>Conduct experiments.</p> <p>Understand the following terminology:</p> <ul style="list-style-type: none"> <li>• Conclusions vs. inferences</li> <li>• Variables</li> <li>• Replications</li> <li>• Samples/sample size</li> </ul>
<p><b>Investigate science history as it applies to industry</b></p>	<p>In groups, research topics in science pertaining to your industry. Have students assign roles for each</p>

	<p>member of the group.</p> <p>Present findings in report format or in oral presentations.</p> <p>Investigate science ethics.</p> <p>Recognize the processes available for accountability in industry. For example, OSHA has a Safety and Health Program Assessment Worksheet whereby employers can be rated for safety issues. See <a href="http://www.osha.gov/SLTC/safetyhealth_ecat/mod3.htm">http://www.osha.gov/SLTC/safetyhealth_ecat/mod3.htm</a></p> <p>[Note: Safety and Health is a mandatory subject of bargaining when a workplace is unionized; in both unionized and non-unionized workplaces, an employer cannot create and dominate workplace safety committees (see the National Labor Relations Act).]</p>
<i>Use scientific instruments to measure aspects of the environment</i>	Gather data on time, length, mass, pressure, volume, acceleration, or other measurables using instruments from the job.
<i>Demonstrate an understanding of data</i>	<p>List the processes involved in gathering data.</p> <p>Suggest ways that data can be grouped or organized.</p> <p>Collect specimens.</p> <p>Show how data can be represented (graphically, charts and diagrams, etc.).</p> <p>Construct a model to depict a basic concept.</p>
<i>Identify the seven basic S I (Systeme International) units</i>	<p>Length: meter, m</p> <p>Mass: kilogram, kg</p> <p>Time: second, s</p> <p>Electric current: ampere, A</p> <p>Temperature: Kelvin, K</p> <p>Amount of substance: mole, mol</p> <p>Luminous intensity: candela, cd</p>

	For a dictionary of units, see <a href="http://www.ex.ac.uk/cimt/dictunit/dictunit.htm">http://www.ex.ac.uk/cimt/dictunit/dictunit.htm</a>
<i>Identify S I (Systeme International) Derived units</i>	Choose units appropriate to your industry (hertz, ohm, volt, watt, etc.).  Create a picture dictionary demonstrating the concepts.
<i>Review relevant theories, laws, and models</i>	As relating to your industry, discuss important theories, laws, and models.
<i>Use reference tools to solve problems</i>	Use scientific reference tools (such as the Periodic Table of Elements) to learn more about specific industry concepts.
<i>Practice safe lab procedures</i>	Handle equipment with care.  Demonstrate safety and first aid procedures.  Identify harmful substances.
<b>PHYSICAL SCIENCE</b>	
<i>Understand the cyclical nature of systems</i>	Show, demonstrate, model, track the cycles of any of the following systems: <ul style="list-style-type: none"> <li>• Growth and decay</li> <li>• Food webs</li> <li>• Weather</li> <li>• Water</li> </ul>
<i>Analyze/classify matter according to type</i>	Identify types of matter (solids, liquids, gases). Which types are predominantly used in your area of industry?
<i>Explain the concepts of work and power</i>	Identify machines used in industry.  Identify how energy levels change when work or power is increased/decreased.  Identify fuel sources used in your industry.  Discuss internal and external combustion.  Create a model demonstrating the uses of levers and pulleys.

<p><i>Be familiar with concepts of motion</i></p>	<p>Measure acceleration and deceleration. Understand the relationship between speed and velocity by performing experiments. Recognize waves and vibrations as a type of motion.</p> <p>Understand action and reaction. Review laws pertaining to motion.</p>
<p><i>Understand concepts related to force</i></p>	<p>Show the need for balance of forces acting on an object.</p> <p>Observe centrifugal and centripetal forces in action.</p> <p>Show how friction is created and must be accounted for in using and preserving equipment.</p> <p>Create a chart showing types of lubricants needed in a factory and schedule of maintenance.</p> <p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of inertia.</p> <p>Show the relationship between pressure, mass, and weight.</p>
<p><i>Understand and apply principles relating to the atom</i></p>	<p>Understand that atoms have a positive, negative, or neutral charge. Classify protons, electrons, and neutrons. Identify ions.</p>
<p><i>Investigate forms of and changes in energy</i></p>	<p>Discuss how energy is measured.</p> <p>Observe changes in energy relationships. Identify catalysts and reactants.</p> <p>Identify sources of kinetic and potential energy in your industry.</p>
<p><i>Discuss, apply principles of electricity and electric currents</i></p>	<p>Identify types of circuits and switches.</p> <p>Show the difference between direct and alternating currents. Give examples of the best/most efficient use of each.</p>

	<p>Determine how electricity is measured, and solve problems using these terms. (Example, use Ohm's law to calculate current, resistance, and voltage.)</p> <p>Identify good conductors and insulators, and discuss how to choose them.</p> <p>Understand grounding, and create a visual display of grounding safety practices. Include the threat of static electricity.</p> <p>Show the uses of a vacuum tube by building a model.</p> <p>Compare the following ways of generating electricity:</p> <ul style="list-style-type: none"> <li>• Hydroelectricity</li> <li>• Motors</li> <li>• Solar power</li> <li>• Steam/nuclear</li> <li>• Transformers</li> <li>• Incandescent (light)</li> </ul> <p>Show the implications for your industry.</p> <p>As appropriate to your industry, identify electrochemical energy sources (cells, electrodes, batteries) and the processes of oxidation and reduction.</p>
<p><i>Be familiar with sound waves</i></p>	<p>Compare how sound waves travel between liquids, solids, and air.</p> <p>Examine different types (lengths) of sound waves.</p> <p>Examine decibels safe for human hearing.</p> <p>Identify safety precautions for industry regarding sound tolerance.</p> <p>Be able to use correctly the terms below as they relate to your industry. For example, ask students to write a short essay explaining a demonstration from class and include the following terms:</p> <ul style="list-style-type: none"> <li>• Amplification</li> <li>• Audible range</li> <li>• Frequency</li> </ul>

	<ul style="list-style-type: none"> <li>• Acoustics</li> <li>• Resonance</li> <li>• Speed</li> </ul>
<i>Be familiar with principles of heat</i>	<p>Differentiate between the three types of heat transfer (conduction, convection, radiation).</p> <p>Understand that substances expand and contract due to heating and cooling.</p> <p>Identify purpose and types of insulations used.</p> <p>Differentiate between heat and temperature.</p>
<i>Investigate and apply concepts relating to temperature</i>	<p>Use the temperature scales; convert between Celsius and Fahrenheit.</p>
<i>Explain the concepts of magnetism</i>	<p>Understand that currents create magnetic fields.</p> <p>Identify materials that are good conductors and the properties that make them such.</p> <p>Understand electromagnetic forces present in earth.</p>
<i>Investigate/apply chemical properties</i>	<p>Differentiate between acids and bases. Find pH for substances used in industry.</p> <p>Identify substances used in your industry and classify them by type.</p> <p>Name the major drugs, fertilizers, or additives used in your industry.</p> <p>Define and state examples of chemical reactions.</p> <p>Be familiar with solutions used in your industry.</p> <p>Compare saturated and unsaturated solutions.</p> <p>Determine whether a solution is soluble or insoluble.</p> <p>Explain solute and solvent.</p>

<p><i>Investigate forms of and changes in matter</i></p>	<p>Compare and contrast physical and chemical changes.</p> <p>Discuss the types of physical or chemical changes that take place in your industry from processing raw materials to manufacturing.</p>
<p><i>Understand and apply concepts relating to the elements</i></p>	<p>Examine the four elements that make up 99% of living organisms [hydrogen (H), oxygen (O), nitrogen (N), and carbon (C)].</p> <p>Element groups:</p> <ul style="list-style-type: none"> <li>• Alkali metals</li> <li>• Alkaline earth metals</li> <li>• Transition metals</li> <li>• Other metals</li> <li>• Metalloids</li> <li>• Nonmetals</li> <li>• Halogens</li> <li>• Noble gases</li> <li>• Rare earth elements</li> </ul>
<p><i>Be familiar with principles of light</i></p>	<p>Discuss light as a form of energy. Examine the light spectrum and note the relative smallness of visible light.</p> <p>Describe types of lighting systems.</p> <p>Define reflection and refraction.</p> <p>Explain how light carries information (by lasers), and show examples of the impact on technology/industry.</p> <p>Identify types of lenses.</p>
<p><i>Be familiar with principles of color</i></p>	<p>Diagram the main parts of the eye involved in seeing color (rods, cones).</p> <p>Use prisms to split light into the visible spectrum.</p> <p>Briefly explore color blindness. What precautions should colorblind people take regarding workplace safety?</p> <p>Define situations in which colorblindness impacts a worker's ability to do his/her job.</p>

**LIFE SCIENCE**

<p><b><i>Explain the presence of cells as the identifier of all living organisms</i></b></p>	<p>Examine the cells of organic material used in your industry, using books, the Internet, or a microscope.</p> <p>Recognize that cells divide or replicate to promote growth of an organism.</p> <p>Examine the parts of a cell. Compare the cell to a machine. How do the parts function and rely on each other?</p> <p>Give examples of one-celled and multiple-celled organisms.</p> <p>Review the classification system of all organisms (kingdom, phylum, etc.).</p> <p>Create a circle graph or pie chart (totaling 100%) showing the relationship (in numbers) between the groups of organisms:</p> <ul style="list-style-type: none"><li>• Bacteria</li><li>• Fungi</li><li>• Viruses</li><li>• Insects</li><li>• Plants</li><li>• Vertebrates</li><li>• Invertebrates</li></ul> <p>Compare some of the cell processes (active and passive transport) with the processes in your industry.</p>
<p><b><i>Understand the progress of evolution of organisms</i></b></p>	<p>Recognize how a species will adapt to better fit in its environment over time.</p>
<p><b><i>Explain the role of genetics in human development</i></b></p>	<p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of heredity, including:</p> <ul style="list-style-type: none"><li>• Half of an individual's genes are contributed by each parent</li><li>• Traits that are inherited are either dominant or recessive from the parent(s)</li><li>• Cell division by mitosis vs. meiosis</li><li>• Disabilities are caused either by genetic/inherited conditions (such as</li></ul>

	Down's Syndrome) or in accidents occurring after birth, such as brain damage due to a car accident or a stroke
<i>Investigate/apply</i> <b>principles of human development</b>	Describe the life cycle of humans and other animals.  Use the concept of human development to explain the need for understanding foundation skills in your area. (For example, children do not run before they walk.) Use this concept to explain other events that occur in a natural order in your industry.
<i>Explore</i> <b>additional concepts pertaining to humans and other animals</b>	Give examples of ways organisms adapt to their environment.  As relating to industry, review the concepts of: <ul style="list-style-type: none"> <li>• Aging</li> <li>• Immune system</li> <li>• Skin and Tissues</li> <li>• Blood and hemoglobin</li> <li>• Disease</li> </ul>
<i>Compare/contrast</i> <b>the differences between sexual and asexual reproduction</b>	Determine instances when understanding the concepts of sexual reproduction are important for your industry.  Highlight the effects of unsafe working practices on unborn fetuses or the dangers present for pregnant women working in industry.
<i>Show</i> <b>a general understanding of the importance of health</b>	Explore the cost of lost wages and worker's compensation in the past year due to health problems.  Research the most common health problems among workers (workers with safe jobs; workers with most hazards to health, etc.).
<i>Investigate</i> <b>the food cycle</b>	Identify food chains, food webs, food pyramids. Show how changes to the food cycle affect the environment and humans. Name the food groups.
<i>Understand</i> <b>nutrition and the body's need for a diet that provides vitamins and minerals</b>	Show an understanding of body systems (circulatory, nervous, digestive, etc.) as they

	<p>relate to industry.</p> <p>Identify deficient vitamins and minerals among a particular population (American workers, workers in specific environments, workers who do not go outdoors, or those who always work outdoors) and the health risks associated with job types (office work, mining work, etc.).</p>
<p><i>Observe</i> <b>health code/sanitation requirements</b></p>	<p>Research the development of health code and sanitation requirements, including OSHA.</p> <p>Compare/contrast workplaces of 1850, 1900, 1950, and 2000 regarding health and safety.</p> <p>Discuss the most common workplace violations of health requirements and present in a graphic format (e.g., maps, charts).</p> <p>Discuss potential effects of ignoring health requirements.</p> <p>After identifying workplace hazards, create several plans to treat the problem. Debate the benefits of each.</p> <p>To avoid the threat of employers choosing ineffective means of ensuring safety on the job, locate MSDS sheets, first aid stations, personal protective equipment, worker's compensation claims offices/paperwork, etc.</p> <p>Using workplace materials*, locate the section on safety regulations. Ask students to rank the items. Debate the importance of each. Determine the threat of ignoring regulations. Research which regulations are often disregarded.</p> <p>Explore proactive measures students can take to extend their health.</p> <p>Understand the importance of mental health in addition to physical health.</p>
<p><i>Investigate/apply</i> <b>principles of anatomy and physiology</b></p>	<p>As relating to your industry, explore issues relating to anatomy and physiology.</p>

	<p>Study the skeletal system--the bones of the arm, hand, and neck. Research carpal-tunnel syndrome.</p> <p>Identify the types of fractures and those most common to your line of work. Learn how to prevent falls.</p>
<p><i>Understand</i> <b>basic principles of ecology</b></p>	<p>Define ecology.</p> <p>Identify five major ways in which people interact with the environment, especially as relating to your industry.</p> <p>Discuss the effectiveness of the media as compared with pro-science groups (such as Greenpeace) on the public's awareness of important environmental issues.</p> <p>Identify any areas of concern regarding waste/waste management in your industry.</p> <p>Show the difference between a niche, community, habitat, and ecosystem.</p> <p>Give examples of herbivores, carnivores, and omnivores. How does your industry use and serve each group?</p> <p>Understand predators' effects on food chains. Identify predators of industry.</p> <p>Explain the process of decomposition and decay. How does industry interfere with or interrupt these processes?</p>
<p><i>State</i> <b>the differences between viruses and bacteria</b></p>	<p>Define viruses and bacteria. Explore viral and bacterial threats present in the workplace. How can they be prevented? How can they be treated?</p> <p>State the benefits of viruses and bacteria.</p> <p>Explain the recent increased resistance to drugs and antibiotics.</p>
<p><i>Understand</i> <b>basic concepts relating to plants</b></p>	<p>Describe the interchange of oxygen and carbon dioxide between plants. Contrast it with the way humans exchange oxygen and carbon dioxide.</p>

	<p>As relating to industry, review the concepts of:</p> <ul style="list-style-type: none"> <li>• Fertilization</li> <li>• Parts of a plant and functions of each</li> <li>• Effects of temperature on plants</li> <li>• Need for water and light</li> <li>• Photosynthesis</li> </ul>
<b>EARTH SCIENCE</b>	
<b><i>Recognize earth's position in the universe</i></b>	<p>As relating to your industry, identify relevant topics regarding:</p> <ul style="list-style-type: none"> <li>• Asteroids</li> <li>• Comets</li> <li>• Stars</li> <li>• Galaxies</li> </ul> <p>Identify the planets in the solar system. Compare and contrast earth with other planets.</p> <p>Create a model showing the relative size of earth within our solar system. Use mathematical relationships to make sure the scale is correct (earth is the size of ____, so the sun should be the size of ____).</p> <p>How do the phases of the moon and sun affect the hemispheres?</p>
<b><i>Investigate the history of the earth</i></b>	<p>Identify geological, chemical, and other methods of determining the age of an object.</p> <p>Demonstrate that fossils and rocks are indicators of previous eras.</p> <p>As a class, create a timeline indicating the age of the earth. Include the various ages (Ice Age, etc.) and the length of each. Make sure the timeline is drawn to scale. Assign each age to a group and research the following:</p> <ul style="list-style-type: none"> <li>• Weather</li> <li>• Major events at beginning and end of age</li> <li>• Organisms living during this time</li> <li>• Factors that made the age unique</li> </ul>
<b><i>Investigate physical characteristics of the earth</i></b>	Label/model the components of the earth.

	<p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of gravity.</p> <p>Solve problems of longitude, latitude, and time zones.</p> <p>Create a model of the ratio of land and water on earth.</p>
<i>Investigate</i> <b>physical forces acting on the earth</b>	<p>Examine erosion and depletion of nonrenewable resources.</p> <p>Identify natural disasters such as hurricanes and earthquakes. Research the effects of a past disaster on a specific industry.</p> <p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of plate tectonics (the earth's surface is broken into large plates; movement of these plates over time causes earthquakes and other geologic activity).</p>
<i>Explain</i> <b>the basic components of earth's rotation</b>	<p>Understand that the earth spins on its axis at an angle of 23 ½ degrees. Identify the period of one complete rotation as a day; longer cycles of rotations identify the seasons.</p> <p>Discuss time zones.</p>
<i>Identify</i> <b>the earth's atmosphere and its components</b>	<p>Identify the main elements in the earth's atmosphere (nitrogen and oxygen).</p> <p>Identify layers of the atmosphere and ozone layer.</p> <p>Explain concepts of air pressure.</p>
<i>Understand</i> <b>basic principles of the solar system</b>	<p>Demonstrate how the sun strikes the earth at different angles depending on location.</p>
<i>Demonstrate</i> <b>the relationship between climate and weather</b>	<p>Identify the factors that create weather.</p> <p>Show how landscape features are affected by changes in climate or weather.</p>

	<p>Identify the greenhouse effect. How does industry contribute to it?</p> <p>Describe the relationship between altitude and weather.</p> <p>Understand that changes in the weather may be seen as fronts that are put in motion by the jet stream.</p> <p>Identify types of precipitation.</p> <p>Differentiate between types of clouds.</p> <p>Understand the effect of winds, wind speeds, and impacts on vegetation.</p>
<p><i>Learn and apply concepts relating to the oceans</i></p>	<p>Label the major oceans and seas. Determine the elements in ocean water (nearly all elements are present).</p> <p>Identify or draw the structural components of the ocean floor.</p> <p>Explain the relationship between the moon and the tides.</p> <p>Explore ways the ocean is used for power and business.</p>
<p><i>Investigate principles of water</i></p>	<p>Identify the parts of the water cycle and the effects of the processes involved.</p> <p>Define water's chemical properties:</p> <ul style="list-style-type: none"> <li>• Water is the universal solvent</li> <li>• Water has a neutral pH of 7</li> <li>• Chemically, water is one atom of oxygen bound to two atoms of hydrogen</li> </ul> <p>Measure salinity. Which industries rely heavily on water?</p> <p>Define water's physical properties:</p> <ul style="list-style-type: none"> <li>• Water is the only natural substance that exists as solid, liquid, and gas</li> <li>• Water's surface has a high density</li> <li>• Water has a high tolerance for heat (heat</li> </ul>

	<p>index)</p> <ul style="list-style-type: none"> <li>• Water's weight</li> <li>• Water as a coolant</li> <li>• Specific gravity</li> </ul>
<p><i>Investigate conservation of physical and natural resources</i></p>	<p>As relating to your industry, discuss or debate the issues of:</p> <ul style="list-style-type: none"> <li>• Allocation of resources</li> <li>• Recovering resources</li> <li>• Best/worst methods of using resources</li> </ul> <p>Compare/contrast renewable and nonrenewable resources.</p> <p>Note the important developments in your industry regarding mineral, soil, water, and wildlife conservation.</p> <p>Discuss alternative sources of energy as relating to your industry.</p>
<p><i>Investigate issues regarding scientific technology</i></p>	<p>As relating to your industry, discuss the uses of technology. What are the newest developments? What effects does the technology have on our society? Political system? Discuss the role of economics on technology.</p>
<p><i>Apply science principles/laws to environmental issues</i></p>	<p>Discuss how humankind alters the earth and environment through pollution and the use of resources and technology.</p>

# Crosswalk to SkillsUSA

SkillsUSA, the co-curricular student organization for Technical & Professional Education, provides many opportunities through its program of work for students to apply the knowledge, skills, and processes learned in a variety of courses. A correlation of the Aviation Maintenance Technology contest to selected tasks/competencies in Arkansas's Aviation Technology courses is provided as a supplement to this framework.

## **Purpose**

To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of aviation maintenance technology

## **Clothing Requirement**

Official light blue work shirt and navy pants, black or brown leather work shoes, and safety glasses with side shields or goggles. (Prescription glasses can be used only if they are equipped with the side shields. If not, they must be covered with goggles.) To purchase official work clothes, contact Midwest Trophy Manufacturing Co., Inc., by calling 1-800-324-5996 or order online at <http://www.mtmrecognition.com/skillsusa>.

## **Eligibility**

Open to active SkillsUSA members enrolled in programs with aviation maintenance technology as the occupational objective

## **Equipment and Materials**

- Supplied by the technical committee:
  - All necessary tools and equipment for the contest
- Supplied by the contestant:
  - Calculator

## Scope of the Contest

- The scope of the contest will be consistent with the airframe and power plant mechanics certification guide published by the Department of Transportation Federal Aviation Administration Advisory Circular EA-AC-65-2D.
- The contest for high school contestants will cover those competencies classified as general aviation by the FAA. The contest for college/postsecondary contestants will cover those competencies classified as power plant and airframe by the FAA.
- A total of eight to 15 operations will be assigned. Each operation must be broken down into specific criteria and points assigned based on the difficulty of the task.
- Contestants will demonstrate their ability to perform jobs and skills selected from the following list of competencies as determined by the SkillsUSA Championships technical committee: (Committee membership includes American Airlines, Federal Aviation Administration, Flight Safety Cessna International, International Association of Machinist and Aerospace Workers, Snap-On Inc., United Airlines, and United Parcel Service.)

### a. Structure

1. Install special rivets and fasteners
2. Inspect bonded structures
3. Install conventional rivets
4. Lay out sheet metal
5. Inspect honeycomb structure
6. Repair windows
7. Repair doors
8. Inspect sheet metal structure

### b. Services

1. Repair and service aircraft and aircraft engines to ensure airworthiness
2. Repair, replace, and assemble parts, such as wings, fuselage, tail assembly, landing gear, control cables, propeller assembly, and fuel and oil tanks
3. Repair or replace worn to damaged components, such as carburetors, superchargers, and magnetos, using hand tools, gauges, and testing equipment
4. Remove engine from aircraft, using hoist and forklift truck

5. Disassemble and inspect parts for wear, warping, or other defects
6. Repair or replace defective engine parts, and reassemble and install engine in aircraft
7. Adjust and repair electrical wiring systems, aircraft accessories, and instruments
8. Perform miscellaneous duties to service aircraft, including flushing crankcase, cleaning screens, greasing moving parts, and checking brakes

**c. Use of Tools**

1. Use of power shears, sheet metal breaker, arc and acetylene welding equipment, a rivet gun, and air or electric drills to rebuild airframe or its components

**d. Use of Manuals**

1. Consult manufacturer's manual and airline maintenance manual for specifications to determine feasibility of repair or replacement according to malfunction

**e. Examination of Engines**

1. Examine engines for cracked cylinders and oil leaks, and listen to detect sounds of malfunctioning, such as sticking or burnt valves

**f. Testing**

1. Test engine operation using testing equipment—such as ignition analyzer, compression checker, distributor timer, and ammeter—to locate source of malfunction

**General Information**

1. Tasks assigned to a contestant will not have a set time limit or sequence.
2. The following shop safety rules will be followed:
  - a. Safety glasses must be used
  - b. No loose clothing is permitted
  - c. Long hair must be tied behind the head and netted or worn under a cap
  - d. No jewelry will be allowed

**Items Evaluated**

Points will be assigned by technical committee members based on the difficulty of the task.

Contestants will be given a written test and oral professional assessment.

# Arkansas' All Aspects of Industry

## Defining “All Aspects”

All aspects of an industry include, with respect to a particular industry that a student is preparing to enter, planning, management, finance, technical and production skills, underlying principles of technology, labor and community issues, health and safety, and environmental issues related to that industry. Planning is examined at the level of both an individual business and the overall industry. Planning elements might include:

- Developing strategic plans—mission, vision, goals, objectives, and/or a plan of action.
- Working with planning tools such as surveys, market research, and competitive analysis.
- Anticipating needs for staffing and major purchases of equipment and supplies.
- Developing plans for training and upgrading of staff.
- Forecasting market trends.
- Developing business plans for entrepreneurial ventures.

Management addresses methods typically used to manage enterprises over time within the industry as well as methods for expanding and diversifying workers' tasks and broadening worker involvement in decisions. Key elements of management might include:

- Using an organization chart to explain how a corporate chain of command works.
- Providing input for strategic plans and communicating the company's vision and mission statements.
- Leading employees in carrying out strategic plans and action plans.
- Evaluating employee performance.
- Anticipating technology and other major purchasing needs.
- Ensuring equity and access for employees.
- Resolving conflicts.
- Developing job descriptions and written policies/procedures.
- Identifying recruitment procedures, training opportunities, methods of evaluation, and retention strategies.
- Working with professional associations and community outreach efforts.

Finance examines ongoing accounting and financial decisions and different methods for raising capital to start or expand enterprises. Finance functions might include:

- Developing budgets.
- Preparing financial statements.
- Analyzing and managing financial transactions and records.
- Implementing payroll procedures.
- Determining and paying taxes.
- Identifying indirect wage costs (benefits, FICA, insurance, worker's compensation).
- Making loans and granting credit to customers.
- Developing graphs and charts related to company finances.
- Identifying and implementing methods of sustaining profitability of a business.
- Managing 401K plans.
- Identifying sources of capital.

Technical and production skills cover specific production techniques and alternative methods for organizing the production work, including methods that diversify and rotate workers' jobs.

Technical and production skills that an employee should have to succeed in a business or industry might include:

- Developing and upgrading job-specific skills.
- Using troubleshooting and problem-solving techniques.
- Analyzing information to make decisions.
- Identifying and implementing quality assurance techniques.
- Employing communication skills, such as writing, listening, speaking, and reading.
- Participating in team efforts.
- Implementing projects and new techniques.
- Demonstrating basic computer skills; employing time-management techniques in completing projects and assigned tasks.
- Demonstrating ethical behavior and work ethic.

Underlying principles of technology provide an integrated study across the curriculum of the mathematical, scientific, social, and economic principles that underlie the industry's technology.

Principles of technology that an employee should know might be demonstrated by:

- Exhibiting proficiency in mathematical and scientific functions related to new and emerging technologies.
- Continuously upgrading job skills needed to implement new technologies.
- Participating in industry certification programs.
- Cross-training to enhance one's value to the organization and to enhance job promotion opportunities.
- Understanding and adhering to ethical issues related to technologies.

Labor issues examine worker rights and responsibilities, labor unions and labor history, and methods for expanding workers' roles. Labor issues might include:

- Understanding and implementing worker rights and responsibilities.
- Working with labor unions.
- Keeping abreast of local, state, and federal legislation affecting employee and employer rights and responsibilities.
- Negotiating and settling worker disputes.
- Identifying certification requirements for specific jobs.
- Analyzing the impact of labor agreements on business operations.

Community issues explore the impact of the industry on the community and the community's impact on and involvement with the industry. Concepts of business and community relations might include:

- Developing and working with community outreach projects.
- Participating on advisory committees and community organizations.
- Working with professional associations.
- Developing and implementing public relations plans.
- Participating in community service projects.

Health, safety, and environmental issues examine these concepts in relation to both the workers and the larger community. Concepts related to health, safety, and the environment might include:

- Identifying and implementing federal, state, and local regulations related to the health and safety of employees.
- Understanding and strictly adhering to federal, state, and local environmental regulations related to the business.
- Identifying job-specific health hazards and safety issues.
- Identifying and implementing basic safety and first aid training techniques for emergencies such as personal illness or injury, tornadoes, fires, nuclear accidents, floods, and incidences of employee-rage or violent behavior.
- Communicating safety regulations and plans to employees.
- Working with selected community groups to implement safety programs.