

# **STATE SKILL STANDARDS METALWORKING**

## **Career & Technical Education**

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*Skills for Employment & Lifelong Learning*



Prepared by:

Office of Career, Technical, and Adult Education  
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Adopted by the State Board of Education /  
State Board for Occupational Education on  
March 19, 2005

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## **Acknowledgements**

The development of this skill standards project was a collaborative effort sponsored by the Office of Career, Technical, and Adult Education at the Department of Education and the Center for Workforce Development at the University of Nevada, Las Vegas. Most important, however, is recognition of the time, expertise and great diligence provided by the writing team members in developing this first draft of the Occupational Skill Standards for Metalworking.

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## Introduction

The Department of Education has undertaken an ambitious effort to develop statewide occupational skill standards. The standards in this document are for metalworking programs and are designed to clearly state what the student should know and be able to do upon completion of an advanced high-school program.

The writing team determined that any statewide skill standards for programs that teach metalworking should be designed to teach entry-level and advanced skills related to industry standards. The standards cover the following areas: (1) Safety; (2) Measurement and Layout; (3) Metallurgy; (4) Tools and Machines; (5) Welding; (6) Sheet Metal; (7) Machine Tools; (8) Employability Skills. The standards also include the math skills students need to be successful in the industry.

These exit-level standards are designed for advanced programs, for students completing at minimum a two-year metalworking program. Students at the appropriate level of instruction will be expected to demonstrate competence for all performance indicators in the “meets standard” domains for each performance standard. Teachers are encouraged to use them to focus curriculum objectives for entry-level programs, also.

The standards are organized as follows:

**Content Standards** are general statements that identify major areas of knowledge, understanding, and skills students are expected to learn in key subject and career areas by the end of the program.

Following each Content Standard are a number of **Performance Standards**. Performance Standards identify the more specific components of each content standard and define the expected abilities of students within each content standard.

Each Performance Standard is analyzed into specific **Performance Indicators**. Performance Indicators are very specific criteria statements for determining whether a student exceeds the standard, meets the standard, or whose performance approaches the standard. Performance Indicators may also be used as learning outcomes which teachers can identify as they plan their program learning objectives.

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## Content and Performance Standards

### General Lab Safety

**Content Standard 1.0: Students shall demonstrate safe work practices while performing operations in the metals lab.**

**Safety Requirements:** Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

<b>Performance Standard 1.1 The student will demonstrate adherence to general lab safety rules including but not limited to those listed in the following performance indicators.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Customize or develop a lab safety program.</li><li>• Obtains certification in First Aid/CPR.</li><li>• Provide a lab safety demonstration to students.</li></ul>
<b>MEETS STANDARD</b>	<ul style="list-style-type: none"><li>1.1.1 Pass safety test.</li><li>1.1.2 Identify and utilize proper storage for flammables.</li><li>1.1.3 Identify ventilation hazards and take corrective action.</li><li>1.1.4 Demonstrate the ability to keep a clean, orderly, and safe work area.</li><li>1.1.5 Demonstrate safe use of personal protective equipment.</li><li>1.1.6 Demonstrate safe use of machines, tools, and equipment.</li><li>1.1.7 Portray safe behaviors/attitudes while in the working environment.</li><li>1.1.8 Explain proper steps in reporting an injury/accident or emergency.</li><li>1.1.9 Demonstrate proper lifting techniques.</li><li>1.1.10 Identify and use hearing protection when needed.</li><li>1.1.11 Explain the purpose of OSHA.</li><li>1.1.12 Demonstrate the safe handling of compressed gases under the direct supervision of the instructor.</li></ul>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Read safety requirements found in the metalworking lab.</li><li>• Identify safety procedures of machines, tools, and equipment.</li><li>• Identify safe behaviors/attitudes.</li><li>• List different types of hearing protection.</li></ul>

Nevada Academic Standards Correlation:

Science: 24.12.1, 24.12.2, 24.12.3

Content and Performance Standards  
**General Lab Safety**

**Content Standard 1.0:**     **Students shall demonstrate safe work practices while performing operations in the metals lab.**

<b>Performance Standard 1.2    The student will demonstrate adherence to specific lab fire safety rules and procedures including but not limited to those listed in the following performance indicators.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Create a fire safety program.</li></ul>
<b>MEETS STANDARD</b>	<p>1.2.1 Describe the use of fire extinguishers / blankets. 1.2.2 Discuss the various types of fires Class A, B, C and D. 1.2.3 Demonstrate fire evacuation procedures. 1.2.4 Discuss and list potential fire hazards related to metalworking. 1.2.5 Demonstrate use of ventilation system controls in the metalworking lab. 1.2.6 Demonstrate proper storage of flammable materials.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Read fire safety requirements found in the metalworking lab.</li><li>• Identify fire evacuation procedures.</li><li>• Identify all locations of fire extinguishers, safety blankets, and exit routes.</li></ul>

Nevada Academic Standards Correlation:  
Science: 20.12.5, 24.12.1, 24.12.2

Content and Performance Standards  
**Measurement and Layout Techniques**

**Content Standard 2.0:**      **Students will demonstrate proper use of layout tools/measuring tools and techniques that are commonly found in the metals lab.**

**Safety Requirements:**    Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

<b>Performance Standard 2.1    Students will use measuring tools to complete required lab assignments.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Demonstrate use of metric measuring devices to one millimeter.</li><li>• Demonstrate appropriate measuring techniques to peers.</li></ul>
<b>MEETS STANDARD</b>	2.1.1    Demonstrate the use of semi-precision measuring devices to 1/64". 2.1.2    Demonstrate the use of precision measuring devices to include micrometers and vernier calipers to 0.001".
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Identify semi-precision measuring devices.</li><li>• Identify precision measuring devices.</li></ul>

Nevada Academic Standards Correlation:  
Math: 3.12.2, 3.12.3



Content and Performance Standards  
Measurement and Layout Techniques

**Content Standard 2.0:**     **Students will demonstrate proper use of layout tools/measuring tools and techniques that are commonly found in the metals lab.**

<b>Performance Standard 2.2    Students will be able to use and apply layout tools to complete required lab projects.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Layout complex shapes and angles other than 45° and 90°.</li></ul>
<b>MEETS STANDARD</b>	2.2.1    Demonstrate use of a combination square set, dividers, scratch awls, layout dye, soap stone, framing square, levels, trammel points and center punch. 2.2.2    Demonstrate use of bar and c-clamps, jigs, and fixtures. 2.2.3    Layout basic shapes and angles.
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Identify common layout tools.</li><li>• Observe a video and/or demonstration on layout tools and techniques.</li></ul>

Nevada Academic Standards Correlation:  
Math: 3.12.2, 3.12.3, 3.12.5

Content and Performance Standards  
Measurement and Layout Techniques

**Content Standard 2.0:**     **Students will demonstrate proper use of layout tools/measuring tools and techniques that are commonly found in the metals lab.**

<b>Performance Standard 2.3   Students will be able to interpret basic prints and develop a working drawing.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Draw orthographic projections with an isometric or oblique view.</li><li>• Identify twenty blueprint acronyms and symbols.</li></ul>
<b>MEETS STANDARD</b>	2.3.1   Develop a paper pattern as it applies to a sheet metal project. 2.3.2   Interpret symbols as they apply to working drawings. 2.3.3   Use orthographic projections to complete a working drawing.
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Differentiate between a working drawing and an orthographic projection.</li></ul>

Nevada Academic Standards Correlation:

Math: 3.12.2, 3.12.5, 4.12.1, 4.12.7, 4.12.8, 9.6, 9.8

Content and Performance Standards  
Measurement and Layout Techniques

**Content Standard 2.0:**     **Students will demonstrate proper use of layout tools/measuring tools and techniques that are commonly found in the metals lab.**

<b>Performance Standard 2.4   Students will be able to apply basic mathematical skills common to the metalworking industry.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Apply math solutions in the metalworking lab using geometry.</li></ul>
<b>MEETS STANDARD</b>	2.4.1   Apply math solutions using whole numbers, fractions, and decimals as they relate to metalworking lab projects. 2.4.2   Solve mathematical problems using handbooks, tables, charts, and graphs.
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Identify whole numbers, fractions, and decimals.</li></ul>

Nevada Academic Standards Correlation:  
Math: 1.12.1, 1.12.3, 6.13, 8.11, 9.6, 9.7, 9.8  
Science: 23.12.2

## Content and Performance Standards

### Metallurgy

**Content Standard 3.0: Students will identify the classification and physical properties of different types of metals.**

**Safety Requirements:** Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

#### **Performance Standard 3.1 Students will identify metal types and shapes.**

<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Demonstrate magnet and file test.</li><li>• Identify characteristics of metal alloys.</li></ul>
<b>MEETS STANDARD</b>	<ul style="list-style-type: none"><li>3.1.1 Perform a spark test to determine ferrous or non-ferrous metals.</li><li>3.1.2 Identify metals such as steel, cast iron, aluminum, stainless steel, copper, brass, and zinc.</li><li>3.1.3 Define properties used to identify common metals (i.e., tensile strength, hardness, malleability, ductility).</li><li>3.1.4 List the five most common shapes of metal.</li><li>3.1.5 Identify thickness by using a wire gauge.</li></ul>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Describe metal-making processes.</li><li>• Observe a metal-making process video.</li></ul>

Nevada Academic Standards Correlation:

Math: 3.12.2

English: 7.12.5

Science: 2.12.1

Content and Performance Standards  
Metallurgy

**Content Standard 3.0:** Students will identify the classification and physical properties of different types of metals common to industry.

<b>Performance Standard 3.2 Students will describe and apply the principles of metallurgy as they apply to hardening and annealing.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Demonstrate the tempering process.</li></ul>
<b>MEETS STANDARD</b>	3.2.1 Demonstrate the hardening process. 3.2.2 Demonstrate the annealing process. 3.2.3 Demonstrate safe methods of handling hot metals.
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Explain the difference between tempering, hardening, and the annealing processes.</li></ul>

Nevada Academic Standards Correlation:  
Science: 3.12.1, 24.12.1

Content and Performance Standards  
Metallurgy

**Content Standard 3.0:** Students will identify the classification and physical properties of different types of metals common to industry.

<b>Performance Standard 3.3</b> Students will describe the effects of heating and cooling of metals to be fabricated.	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Demonstrate how metal is deformed during heating and cooling.</li></ul>
<b>MEETS STANDARD</b>	3.3.1 Describe expansion and contraction as a result of heating and cooling metals. 3.3.2 Demonstrate safe methods of handling hot metals.
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Recognize hot materials in the metalworking lab.</li></ul>

Nevada Academic Standards Correlation:  
Science: 24.12.1

Content and Performance Standards  
**Tools and Machines**

**Content Standard 4.0: Students will safely operate commonly used metalworking machines, and tools.**

Safety Requirements: Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

<b>Performance Standard 4.1 Students will identify and safely operate stationary power machines commonly used in the metals lab.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Perform non-electrical preventative maintenance on machinery to comply with <b>safety</b> requirements.</li></ul>
<b>MEETS STANDARD</b>	4.1.1 Demonstrate safe work practices for stationary power machines, including but not limited to: grinders, buffers, sanders, band saws, chop saws, shears, and presses.
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Identify basic stationary power machines such as grinders, buffers, sanders, band saws, chop saws, shears, and presses.</li><li>• Identify safety features of basic stationary power machines such as grinders, buffers, sanders, band saws, chop saws, shears, and presses.</li><li>• Observe safety video and demonstration.</li></ul>

Nevada Academic Standards Correlation:  
Science: 24.12.1

Content and Performance Standards  
Tools and Machines

**Content Standard 4.0:** Students will safely operate commonly used metalworking machines, and tools.

<b>Performance Standard 4.2 Students will identify and safely operate portable power machines commonly found in the metals lab.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Perform non-electrical preventative maintenance on portable power machines to comply with safety requirements.</li></ul>
<b>MEETS STANDARD</b>	4.2.1 Demonstrate safe work practices for portable power machines, including but not limited to: grinders, buffers, sanders, band saws, shears, and drills.
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Identify basic portable power machines such as grinders, buffers, sanders, band saws, shears, and drills.</li><li>• Identify safety features of basic portable power machines such as grinders, buffers, sanders, band saws, shears, and drills.</li><li>• Observe safety video and demonstration.</li></ul>

Nevada Academic Standards Correlation:  
Science: 24.12.1



Content and Performance Standards  
Tools and Machines

**Content Standard 4.0:**     **Students will safely operate commonly used metalworking machines, and tools.**

<b>Performance Standard 4.3     Students will identify and safely use hand tools commonly found in the metals lab.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Perform non-electrical preventative maintenance on chisels and punches to comply with safety requirements.</li></ul>
<b>MEETS STANDARD</b>	4.3.1     Demonstrate safe work practices for hand tools, including but not limited to: pliers, files, chisels, punches, hard face and soft face hammers, hacksaw, vises, and brushes.
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Identify basic hand tools such as pliers, files, chisels, punches, hard face and soft face, hammers, hacksaw, vises, and brushes.</li><li>• Identify safety features of basic hand tools such as pliers, files, chisels, punches, hard face and soft face, hammers, hacksaw, vises, and brushes.</li></ul>

Nevada Academic Standards Correlation:  
Science: 24.12.1

Content and Performance Standards  
**Welding Techniques**

**Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.**

**Safety Requirements:** Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

<b>Performance Standard 5.1 Students will identify, list, and demonstrate use of proper personal safety equipment.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Clean and maintain personal protective safety gear.</li><li>• Develop a personal safety checklist.</li></ul>
<b>MEETS STANDARD</b>	<ul style="list-style-type: none"><li>5.1.1 Identify and list personal safety equipment in the metalworking lab.</li><li>5.1.2 Demonstrate appropriate use of personal safety equipment necessary to complete assigned projects.</li><li>5.1.3 Demonstrate the proper use of ventilation.</li><li>5.1.4 Demonstrate the proper use of personal respiration equipment.</li></ul>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Observe a safety video and/or demonstration.</li><li>• List personal protective safety equipment.</li></ul>

Nevada Academic Standards Correlation:

Science: 24.12.1

English: 7.12.5

Content and Performance Standards  
**Welding Techniques**

**Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.**

<b>Performance Standard 5.2      Students will demonstrate the set-up and operation of oxy-fuel welding and cutting equipment.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"> <li>• Demonstrate the safe handling and storage of compressed gas cylinders under the direct supervision of the instructor.</li> <li>• Demonstrate piercing, slotting, and bevel cutting techniques.</li> <li>• Complete a NIOSH safety check list.</li> </ul>
<b>MEETS STANDARD</b>	<p>5.2.1 Identify, select, and set-up oxy-fuel welding and cutting equipment.</p> <p>5.2.2 Select and safely operate oxy-fuel welding and cutting equipment used to complete assigned projects.</p> <p>5.2.3 Layout, cut, and fit materials (such as pipe, plate, and structural shapes).</p> <p>5.2.4 Identify safe handling procedures of cylinders according to OSHA standards.</p> <p>5.2.5 Demonstrate proper methods of cleaning and care of oxy-fuel welding and cutting tips.</p> <p>5.2.6 Identify, select, and use proper filler materials.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"> <li>• List oxy-fuel welding and cutting equipment used to complete assigned projects.</li> <li>• Identify the various types of gas cylinders.</li> </ul>

Nevada Academic Standards Correlation:

Math: 3.12.2, 3.12.3, 4.12.7, 6.2, 6.9, 9.7, 9.8

Science: 24.12.1

Content and Performance Standards  
**Welding Techniques**

**Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.**

<b>Performance Standard 5.3      Students will demonstrate the set-up and operation of Shielded Metal Arc Welding (SMAW) equipment.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Demonstrate appropriate SMAW techniques to peers.</li><li>• Identify SMAW problems, their causes, and take corrective action.</li></ul>
<b>MEETS STANDARD</b>	5.3.1 Identify, select, and set-up SMAW equipment. 5.3.2 Select and <b>safely</b> operate SMAW equipment used to complete assigned projects. 5.3.3 Select appropriate electrodes to complete assignments.
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• List SMAW equipment.</li><li>• Observe SMAW video and/or demonstration.</li></ul>

Nevada Academic Standards Correlation:  
Science:

24.12.1

Content and Performance Standards  
**Welding Techniques**

**Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.**

<b>Performance Standard 5.4      Students will demonstrate the set-up and operation of Gas Metal Arc Welding (GMAW) equipment.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Demonstrate appropriate GMAW techniques to peers.</li><li>• Identify GMAW problems, their causes, and take corrective action.</li></ul>
<b>MEETS STANDARD</b>	<p>5.4.1 Identify, select, and set-up GMAW equipment.</p> <p>5.4.2 Select and <b>safely</b> operate GMAW equipment used to complete assigned projects.</p> <p>5.4.3 Select appropriate wire and gas to complete assignments.</p> <p>5.4.4 Select, set-up, and <b>safely</b> operate Flux Core Arc Welding (FCAW) equipment.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• List GMAW / FCAW equipment.</li><li>• Observe GMAW video and/or demonstration.</li></ul>

Nevada Academic Standards Correlation:  
Science: 24.12.1

Content and Performance Standards  
**Welding Techniques**

**Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.**

<b>Performance Standard 5.5 Students will demonstrate the set-up and operation of Gas Tungsten Arc Welding (GTAW) equipment.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Demonstrate appropriate GTAW techniques to peers.</li><li>• Identify GTAW problems, their causes, and take corrective action.</li><li>• Demonstrate ability to weld aluminum.</li></ul>
<b>MEETS STANDARD</b>	<p>5.5.1 Identify, select, and set-up GTAW equipment.</p> <p>5.5.2 Select and <b>safely</b> operate GTAW equipment used to complete assigned projects.</p> <p>5.5.3 Select appropriate electrodes and filler materials to complete assignments.</p> <p>5.5.4 Select appropriate gas to complete GTAW assignments.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• List GTAW equipment.</li><li>• Observe GTAW video and/or demonstration.</li></ul>

Nevada Academic Standards Correlation:  
Science: 24.12.1

Content and Performance Standards  
**Welding Techniques**

**Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.**

<b>Performance Standard 5.6 Students will demonstrate the set-up and operation of plasma arc cutting equipment.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Demonstrate appropriate plasma arc cutting techniques to peers.</li><li>• Identify plasma arc cutting problems, their causes, and take corrective action.</li></ul>
<b>MEETS STANDARD</b>	<p>5.6.1 Set-up and <b>safely</b> operate plasma arc cutting equipment used to complete assigned projects.</p> <p>5.6.2 Use appropriate ventilation or personal respirator to complete assignments.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• List plasma arc cutting equipment.</li><li>• Observe a plasma arc cutting demonstration.</li></ul>

Nevada Academic Standards Correlation:  
Science: 24.12.1

Content and Performance Standards  
**Sheet Metal**

**Content Standard 6.0:**     **Students will demonstrate layout, forming, and fastening techniques.**

Safety Requirements:    Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

<b>Performance Standard 6.1    Students will demonstrate pattern development and layout techniques.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Demonstrate the use of radial line, parallel line, and triangulation development.</li><li>• Demonstrate how to find true length lines.</li></ul>
<b>MEETS STANDARD</b>	6.1.1    Construct paper patterns for a simple sheet metal project. 6.1.2    Layout directly on metal using dyes, scribes, dividers, trammel points, and edge gauges. 6.1.3    Identify edges and seams used in typical sheet metal layout. 6.1.4    Demonstrate the use of a sheet metal gauge.
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Identify sheet metal layout tools.</li><li>• Observe a demonstration(s).</li></ul>

Nevada Academic Standards Correlation:

Math: 3.12.2, 3.12.3, 3.12.5, 4.12.1, 4.12.7, 4.12.8, 6.2, 6.9, 9.7, 9.8



Content and Performance Standards  
Sheet Metal

**Content Standard 6.0: Students will demonstrate layout, forming, and fastening techniques.**

<b>Performance Standard 6.2 Students will identify and demonstrate the use of sheet metal forming machines and hand tools.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Demonstrate the ability to make a Pittsburgh seam by hand.</li><li>• Perform basic preventative non-electrical maintenance on machines and tools to comply with <b>safety</b> requirements for optimal performance levels.</li></ul>
<b>MEETS STANDARD</b>	<p>6.2.1 Form sheet metal using a box and pan break, bar folder, slip roll, and a rotary machine for an assigned project.</p> <p>6.2.2 Cut sheet metal using foot shears, hand shears, Beverly shears, and Whitney punches for an assigned project.</p> <p>6.2.3 Use appropriate cutting and folding techniques to complete assigned project.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Identify the various types of shears, breaks, and folders.</li></ul>

Content and Performance Standards  
Sheet Metal

**Content Standard 6.0: Students will demonstrate layout, forming, and fastening techniques.**

<b>Performance Standard 6.3 Students will identify and demonstrate the use of various sheet metal fastening techniques.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Join metal together using a Pittsburgh seam.</li><li>• Join metal together using low temperature solder.</li></ul>
<b>MEETS STANDARD</b>	6.3.1 Demonstrate the ability to join sheet metal together with rivets, resistance welding, and seaming techniques. 6.3.2 Identify and list the various sheet metal fastening techniques.
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Identify types of rivets and seams.</li></ul>

Nevada Academic Standards Correlation:  
English: 7.12.5

## Content and Performance Standards

### Machine Tools

**Content Standard 7.0: Students will identify and safely operate machine tools commonly used in the metalworking lab.**

**Safety Requirements:** Comply with personal and environmental safety practices associated with clothing; eye and hearing protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of materials in accordance with local, state, and federal safety and environmental regulations.

<b>Performance Standard 7.1 Students will set-up and safely operate the metal cutting lathe.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Demonstrate the ability to turn a taper using one of the three taper cutting techniques.</li><li>• Demonstrate the ability to cut threads.</li><li>• Demonstrate the ability to center a tailstock.</li><li>• Demonstrate the ability to indicate a work piece in a four-jaw chuck.</li><li>• Demonstrate the ability to use a boring bar.</li></ul>
<b>MEETS STANDARD</b>	<p>7.1.1 Identify basic components of lathes.</p> <p>7.1.2 Use charts and tables to determine cutting, drilling, and knurling speeds.</p> <p>7.1.3 Select proper cutting tool based on job requirements.</p> <p>7.1.4 Demonstrate the ability to <b>safely</b> face, straight turn, shoulder turn, center drill, and knurl a work piece.</p> <p>7.1.5 Demonstrate ability to <b>safely</b> sharpen cutting tools.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• List the basic components of lathes.</li><li>• List the different cutting tools.</li><li>• Observe a demonstration(s).</li></ul>

Nevada Academic Standards Correlation:

Math: 3.12.2, 3.12.3, 3.12.5

Science: 23.12.2, 24.12.1

Content and Performance Standards  
**Machine Tools**

**Content Standard 7.0: Students will identify and safely operate machine tools commonly used in the metalworking lab.**

<b>Performance Standard 7.2 Students will set-up and safely operate milling machines.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Locate an edge with edge finder.</li><li>• Mill an external radius with a rotary table.</li><li>• Mill a work piece using simple indexing operation.</li></ul>
<b>MEETS STANDARD</b>	<p>7.2.1 Identify all of the components of vertical milling machines.</p> <p>7.2.2 Demonstrate the ability to <b>safely</b> apply work-securing devices.</p> <p>7.2.3 Use charts and tables to determine feeds and speeds.</p> <p>7.2.4 Select appropriate cutting tool based on assigned project.</p> <p>7.2.5 Demonstrate the ability to <b>safely</b> mill to a specified size.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• List the components of the vertical milling machine.</li><li>• List the different cutting tools used in the milling process.</li></ul>

Nevada Academic Standards Correlation:

Math: 3.12.2, 3.12.3, 3.12.5

Science: 23.12.2, 24.12.1

Content and Performance Standards  
**Machine Tools**

**Content Standard 7.0: Students will identify and safely operate machine tools commonly used in the metalworking lab.**

<b>Performance Standard 7.3 Students will set-up and safely operate the drill press.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Demonstrate the ability to large hole drill.</li><li>• Demonstrate the ability to drill to depth.</li></ul>
<b>MEETS STANDARD</b>	<p>7.3.1 Identify components of the drill press.</p> <p>7.3.2 Set up and securely clamp a work piece to the drill press table.</p> <p>7.3.3 Use charts and tables to determine cutting speeds and feeds for drilling a specific medium.</p> <p>7.3.4 Select appropriate drill type based on job requirements.</p> <p>7.3.5 Use bench grinder to sharpen drill bits.</p> <p>7.3.6 Demonstrate proper dress and observe <b>safe</b> operating procedures while using the drill press.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• List the components of the drill press.</li><li>• Observe demonstration.</li></ul>

Nevada Academic Standards Correlation:  
Science: 24.12.1

Content and Performance Standards  
**Machine Tools**

**Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.**

<b>Performance Standard 8.1</b> Students shall demonstrate problem-solving skills.	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Develop methods to analyze the advantages and disadvantages of alternative solutions.</li><li>• Devise an action plan for a metalworking problem based on information gained through research of alternative solutions and implement in a group decision/action.</li></ul>
<b>MEETS STANDARD</b>	<p>8.1.1 Solve a metalworking problem using the appropriate steps in the problem-solving process.</p> <p>8.1.2 Demonstrate brainstorming techniques.</p> <p>8.1.3 Examine and explain the advantages and disadvantages of alternative solutions to one or more problems.</p> <p>8.1.4 Create an action plan based upon a solution to a metalworking problem.</p> <p>8.1.5 Identify the benefits of solving a metalworking problem.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• Identify the basic steps in the problem-solving process.</li><li>• Identify alternative solutions to a problem.</li><li>• Identify the basic components of an action plan.</li></ul>

Nevada Academic Standards Correlation:

Math: 6.12.7, 6.12.13, 7.12.1, 7.12.6, 7.12.14

Science: 22.12.2, 24.12.5

English: 4.12.6, 6.12.2, 10.12.2, 10.12.3

Content and Performance Standards  
**Employability Skills**

**Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.**

<b>Performance Standard 8.2</b> Students shall demonstrate critical-thinking skills.	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Analyze how critical-thinking skills affect work performance.</li><li>• Formulate, implement, and evaluate an action plan.</li><li>• Demonstrate the skills necessary to identify, analyze, and solve a design problem.</li></ul>
<b>MEETS STANDARD</b>	<p>8.2.1 Identify and explain the essential elements of the critical-thinking process as related to the metalworking trades.</p> <p>8.2.2 Demonstrate critical-thinking skills necessary in the metalworking trades.</p> <p>8.2.3 Explain how emotional thinking and logical thinking affect decision making in the metalworking trades.</p> <p>8.2.4 Explain the difference between reliable and unreliable observations and statements of fact.</p> <p>8.2.5 Recognize patterns or relationships through observation and discovery.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• State the importance of critical thinking in identifying, analyzing, and solving a metalworking problem.</li><li>• Identify the essential steps of critical thinking.</li><li>• Define emotional and logical thinking.</li><li>• Identify the difference between opinions and statements of fact.</li></ul>

Nevada Academic Standards Correlation:

Math: 2.12.6, 5.12.4

English: 10.12.1

Content and Performance Standards  
**Employability Skills**

**Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.**

<b>Performance Standard 8.3</b> Students shall demonstrate the ability to speak, write, and listen effectively.	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"> <li>• Identify, research, prepare and deliver a metalworking related presentation.</li> <li>• Prepare technical documents relating to bill of materials, blueprints, etc.</li> <li>• Present and defend a metalworking procedure.</li> <li>• Compete in a SkillsUSA job skill demonstration and/or public speaking contest.</li> </ul>
<b>MEETS STANDARD</b>	<p>8.3.1 Explain the benefits of effective communication skills in the workplace.</p> <p>8.3.2 Effectively interpret and respond to verbal and nonverbal messages.</p> <p>8.3.3 Demonstrate proper telephone etiquette.</p> <p>8.3.4 Effectively communicate thoughts, ideas and information in writing.</p> <p>8.3.5 Organize ideas and communicate orally; is able to effectively demonstrate job skills to others.</p> <p>8.3.6 Locate, understand and interpret written information in documents such as manuals, graphs and schedules.</p> <p>8.3.7 Select and utilize an appropriate medium for conveying messages with dignity and respect.</p> <p>8.3.8 Organize information into the appropriate format in accordance with standard practices, which includes prewriting, drafting, proofreading, editing/revising, and preparing final copy.</p> <p>8.3.9 Demonstrate sensitivity to cultural diversity in communication.</p> <p>8.3.10 Identify common communication barriers and methods for improving communication.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"> <li>• Define communications.</li> <li>• Explain the benefits of effective communication in the metalworking trade.</li> <li>• Explain how cultural and physical diversity affect communication.</li> <li>• Identify applicable medium for conveying messages.</li> </ul>

Nevada Academic Standards Correlation:



Math: 5.12.1

English: 4.12.6, 6.12.5, 7.12.1, 7.12.3, 7.12.4, 7.12.5

Content and Performance Standards  
**Employability Skills**

**Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.**

<b>Performance Standard 8.4      Students shall demonstrate the ability to select, apply and maintain appropriate technology</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"> <li>• Critique the use, benefits and cost of technologically advanced equipment in the metalworking trade.</li> <li>• Analyze the impact of technological changes on one or more aspects of metalworking trades by researching current literature.</li> <li>• Compete in a state-level SkillsUSA metalworking contest.</li> </ul>
<b>MEETS STANDARD</b>	<p>8.4.1 Demonstrate ability to utilize basic keyboarding techniques.</p> <p>8.4.2 Demonstrate ability to utilize other input devices.</p> <p>8.4.3 Demonstrate ability to utilize various electronic research methods.</p> <p>8.4.4 Demonstrate knowledge of the basic technology systems currently available and how they apply to your field (i.e., word processing, spreadsheets, multimedia applications and databases).</p> <p>8.4.5 Investigate and explain the use, benefits, and costs of technological developments in the workplace and school.</p> <p>8.4.6 Identify and demonstrate the appropriate use of technology to enhance the efficiency of the workplace and school.</p> <p>8.4.7 Demonstrate routine maintenance and repair of technological equipment.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"> <li>• Recognize technology used in the metalworking trade.</li> <li>• Use an Internet browser to locate specific Websites related to metalworking trades.</li> </ul>

Nevada Academic Standards Correlation:  
Math: 3.12.4

Content and Performance Standards  
**Employability Skills**

**Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.**

<b>Performance Standard 8.5      Students shall demonstrate leadership and teamwork skills.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"> <li>• Analyze the stages of group development.</li> <li>• Demonstrate leadership ability within a group or team.</li> <li>• Compromise and/or build consensus within a group and summarize the decision of the group while maintaining respect for diverse viewpoints.</li> <li>• Complete levels 1-3 of the SkillsUSA Professional Development Program.</li> <li>• Campaign for a local SkillsUSA chapter office.</li> <li>• Serve as a committee chair in a local SkillsUSA chapter.</li> </ul>
<b>MEETS STANDARD</b>	<p>8.5.1      Work cooperatively with others when given group project.</p> <p>8.5.2      Explain traits necessary to effectively lead and influence individuals and groups.</p> <p>8.5.3      Demonstrate appropriate attitudes and behaviors for effective leadership.</p> <p>8.5.4      Demonstrate respect for team members, team processes, and team goals.</p> <p>8.5.5      Participate in the implementation of a group's decision and evaluate the results.</p> <p>8.5.6      Demonstrate the qualities of an effective leader and team member.</p> <p>8.5.7      Describe the importance of a proper dress code.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"> <li>• Explain the importance of groups.</li> <li>• Explain how to organize groups.</li> <li>• Wear appropriate attire.</li> </ul>

Content and Performance Standards  
**Employability Skills**

**Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.**

<b>Performance Standard 8.6      Students shall demonstrate sound workplace ethics.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"><li>• Demonstrate time-management skills and cost-effective practices.</li></ul>
<b>MEETS STANDARD</b>	<p>8.6.1    Develop personal work ethics through work experience.</p> <p>8.6.2    Describe the importance of ethics practiced in the workplace.</p> <p>8.6.3    Demonstrate regular attendance, promptness, and the willingness to follow instructions and complete an assigned task.</p> <p>8.6.4    Demonstrate appropriate personal and professional attitudes and behaviors.</p> <p>8.6.5    Maintain a safe, clean, and organized work area.</p> <p>8.6.6    Demonstrate awareness of legal responsibilities related to individual performance, safety, and customer satisfaction.</p> <p>8.6.7    Demonstrate knowledge of various types of harassment.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"><li>• List the important ethics in the workplace.</li><li>• Meet attendance standards.</li><li>• Describe an organized workplace.</li><li>• Identify appropriate responses to unethical actions.</li></ul>

Content and Performance Standards  
**Employability Skills**

**Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.**

<b>Performance Standard 8.7 Students shall demonstrate the ability to effectively manage resources in high-performance workplaces.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"> <li>• Recognize the individual roles of team members, delegate tasks, and provide feedback on performance.</li> <li>• Acknowledge and utilize the skills, abilities, and input of all members of a team.</li> <li>• Develop an action plan to accomplish tasks within a given time frame.</li> </ul>
<b>MEETS STANDARD</b>	<p>8.7.1 Develop a time schedule and prioritized task list to complete a job assignment.</p> <p>8.7.2 Identify the resources needed to complete a job assignment.</p> <p>8.7.3 Organize the material resources and space requirements needed to complete a job assignment.</p> <p>8.7.4 Effectively use technology to complete a job assignment.</p> <p>8.7.5 Demonstrate cooperation and leadership as a team at school or in a workplace setting.</p> <p>8.7.6 Use the basic components of effective time management.</p> <p>8.7.7 Recognize the need for management skills in the workplace with regard to stress, anger management, and substance abuse.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"> <li>• List effective time management skills.</li> <li>• Use technology to complete assignments.</li> <li>• Utilize materials, tools, and processes to complete a task related to a career selection.</li> <li>• Read and follow instructions from manuals on the use and care of materials, tools, and equipment.</li> <li>• Maintain a clean, organized, and safe job site.</li> <li>• Identify traits needed for cooperation and leadership in a team at school or in a workplace setting.</li> <li>• Identify the material resources and space requirements needed to complete an assignment.</li> </ul>

Content and Performance Standards  
**Employability Skills**

**Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.**

<b>Performance Standard 8.8    Students shall demonstrate career planning and development skills.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"> <li>• Develop a community service or job shadowing project.</li> <li>• Develop an education/training plan to fulfill long-term career goals.</li> <li>• Define advantages and disadvantages of self-employment or working for various sizes and types of businesses.</li> <li>• Critique results of a job interview.</li> <li>• Develop a proposal for an organized community service project.</li> <li>• Compete in a state level SkillsUSA job interview contest.</li> </ul>
<b>MEETS STANDARD</b>	8.8.1 Prepare a job application. 8.8.2 Prepare a personal resume. 8.8.3 Complete a personal aptitude and interest inventory. 8.8.4 Participate in a mock job interview. 8.8.5 Establish short-term career goals. 8.8.6 Establish long-term career goals. 8.8.7 Use the Nevada Career Information System (NCIS) or a similar computer-based program to research careers in a chosen field. 8.8.8 Participate in an organized job-shadowing activity. 8.8.9 Participate in a community service project. 8.8.10 Construct a career portfolio.
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"> <li>• Locate employment opportunities.</li> <li>• Identify job requirements for entry-level positions in the metalworking industry.</li> <li>• Identify general conditions for employment.</li> <li>• Identify educational/training requirements for related metalworking fields.</li> <li>• Identify the elements of goal setting.</li> <li>• Identify metalworking related careers.</li> <li>• Describe essential job interview skills.</li> <li>• Identify the components of a career portfolio.</li> </ul>

Nevada Academic Standards Correlation:

English: 5.12.5, 6.12.5, 7.12.1, 7.12.3, 7.12.4, 7.12.5, 9.12.1

Content and Performance Standards  
**Employability Skills**

**Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.**

<b>Performance Standard 8.9 Students shall demonstrate job-retention and lifelong-learning skills.</b>	
<b>EXCEEDS STANDARD</b>	<ul style="list-style-type: none"> <li>• Maintain an electronic portfolio.</li> <li>• Create a plan for lifelong learning.</li> <li>• Create a presentation illustrating interpersonal skills needed for job retention.</li> <li>• Adapt new knowledge and skills in changing situations.</li> <li>• Analyze how work life is affected by families and how families are affected by work life.</li> </ul>
<b>MEETS STANDARD</b>	<p>8.9.1 Maintain an employment/career portfolio.</p> <p>8.9.2 Explain strategies for balancing work and family roles.</p> <p>8.9.3 Demonstrate understanding of the need for lifelong learning in a rapidly changing job market.</p> <p>8.9.4 Describe strategies to maintain employment in the face of job reductions.</p> <p>8.9.5 Develop long-term career planning strategies.</p> <p>8.9.6 Describe various educational options needed for job retention.</p> <p>8.9.7 Model sound workplace ethics, such as loyalty, punctuality, and initiative.</p> <p>8.9.8 Demonstrate interpersonal skills needed for job retention.</p>
<b>APPROACHES STANDARD</b>	<ul style="list-style-type: none"> <li>• Describe the importance of a portfolio.</li> <li>• Identify options for lifelong learning.</li> <li>• Identify interpersonal skills needed for job retention.</li> <li>• Identify jobs with opportunity for advancement.</li> <li>• Describe the importance of career planning.</li> </ul>

Nevada Academic Standards Correlation:  
 English: 5.12.5, 6.12.5, 7.12.1, 7.12.3, 7.12.4, 7.12.5

## CROSSWALK OF METALWORKING STANDARDS AND ACADEMIC STANDARDS

**Content Standard 1.0:** Students shall demonstrate safe work practices while performing operations in the metals lab.

Performance Indicators	Academic Standards
1.1.6	<u>Science</u> 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards. 24.12.2 Use the information found in materials safety data sheets to handle, store, and dispose of chemicals properly. 24.12.3 Inspect, manipulate, and describe the functions of various parts of technical and scientific equipment.
1.2.1	<u>Science</u> 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
1.2.4	<u>Science</u> 20.12.5 Identify the type of hazard, estimate the extent and consequences of exposure, and determine the options for reducing or eliminating risks.
1.2.5	<u>Science</u> 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
1.2.6	<u>Science</u> 24.12.2 Use the information found in materials safety data sheets to handle, store, and dispose of chemicals properly.

**Content Standard 2.0:** Students will demonstrate proper use of layout tools/measuring tools and techniques that are commonly found in the metals lab.

Performance Indicators	Academic Standards
2.1.1, 2.1.2	<u>Math</u> 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations.
2.2.1	<u>Math</u> 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations. 3.12.5 Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems.
2.2.3	<u>Math</u> 3.12.5 Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems.



Performance Indicators	Academic Standards
2.3.1, 2.3.3	<u>Math</u> 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost distances, interest, temperatures, and weight/mass. 3.12.5 Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems. 4.12.1 Identify and use the properties of polygons and elements of circles to solve practical problems. 4.12.7 Apply the Pythagorean Theorem, its converse, properties of special right triangles, and right triangle trigonometry to solve practical problems. 4.12.8 Construct, justify and defend mathematical conclusion using logical, sequential, deductive reasoning supported by established mathematical principles. 9.6 Use and analyze the connections between Mathematics and other disciplines. 9.8 Identify, explain, and use mathematics in everyday life.
2.4.1, 2.4.2	<u>Math</u> 1.12.1 Calculate and estimate sums, differences, products, quotients, powers, and roots using mental math, formulas, and algorithms. 1.12.3 Apply the properties and theories of the real number system to everyday situations. 6.13 Use technology, including calculators, to solve problems and verify solutions. 8.11 Determine relevant, irrelevant, and/or sufficient information to solve mathematical problems. 9.6 Use and analyze the connections between Mathematics and other disciplines. 9.7 Apply mathematical thinking and modeling to solve problems that arise in other disciplines 9.8 Identify, explain, and use mathematics in everyday life. <u>Science</u> 23.12.2 Use algebraic equations when appropriate.

**Content Standard 3.0:** Students will identify the classification and physical properties of different types of metals.

Performance Indicators	Academic Standards
3.1.2	<u>Science</u> 2.12.1 Investigate and describe intrinsic (color, odor, density) and extrinsic (e.g., size, mass, volume) physical properties of matter.
3.1.4	<u>Science</u> 2.12.1 Investigate and describe intrinsic (color, odor, density) and extrinsic (e.g., size, mass, volume) physical properties of matter. <u>English</u> 7.12.5 Demonstrate conventional spelling.
3.1.5	<u>Math</u> 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass.
3.2.1, 3.2.2	<u>Science</u> 3.12.1 Explain that the transformation of energy usually results in some energy in the form of heat, which spreads by radiation, conduction, and sometimes convection into cooler places.
3.2.3	<u>Science</u> 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.

Performance Indicators	Academic Standards
3.3.2	<u>Science</u> 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.

Content Standard 4.0: Students will safely operate commonly used metalworking machines, and tools.

Performance Indicators	Academic Standards
4.1.1	<u>Science</u> 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
4.2.1	<u>Science</u> 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
4.3.1	<u>Science</u> 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.

Content Standard 5.0: Students will demonstrate proper welding and cutting techniques.

Performance Indicators	Academic Standards
5.1.1	<u>English</u> 7.12.5 Demonstrate conventional spelling.
5.1.2, 5.1.3, 5.1.4	<u>Science</u> 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.2.1, 5.2.2	<u>Science</u> 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.2.3	<u>Math</u> 3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass. 3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations. 4.12.7 Apply the Pythagorean Theorem, its converse, properties of special right triangles, and right triangle trigonometry to solve practical problems. 6.2 Apply previous experience and knowledge to new problem-solving situations. 6.9 Generalize solutions and strategies from earlier problems to new problem situations. 9.7 Apply mathematical thinking and modeling to solve problems that arise in other disciplines. 9.8 Identify, explain, and use mathematics in everyday life.
5.2.4	<u>Science</u> 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.3.2	<u>Science</u> 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.4.2, 5.4.4	<u>Science</u> 24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.
5.5.2	<u>Science</u>

Performance Indicators	Academic Standards
	<b>24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.</b>
<b>5.6.1, 5.6.2</b>	<u>Science</u> <b>24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.</b>

Content Standard 6.0: Students will demonstrate layout, forming, and fastening techniques.

Performance Indicators	Academic Standards
<b>6.1.1</b>	<u>Math</u> <b>3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass.</b> <b>3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations.</b> <b>3.12.5 Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems.</b> <b>4.12.1 Identify and use the properties of polygons (including interior and exterior angles) and elements of circles (e.g., angles, arcs, chords, secants and tangents) to solve practical problems.</b> <b>4.12.8 Use tools, technology, and models to sketch, draw, and construct geometric figures in order to solve problems and to demonstrate the properties of geometric figures.</b> <b>6.2 Apply previous experience and knowledge to new problem-solving situations.</b> <b>6.9 Generalize solutions and strategies from earlier problems to new problem situations.</b> <b>9.7 Apply mathematical thinking and modeling to solve problems that arise in other disciplines (e.g., rhythm in music and motion in science).</b> <b>9.8 Identify, explain, and use mathematics in everyday life.</b>
<b>6.1.2</b>	<u>Math</u> <b>3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass.</b> <b>3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations.</b> <b>3.12.5 Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems.</b> <b>4.12.1 Identify and use the properties of polygons (including interior and exterior angles) and elements of circles (e.g., angles, arcs, chords, secants and tangents) to solve practical problems</b> <b>4.12.7 Apply the Pythagorean Theorem, its converse, properties of special right triangles, and right triangle trigonometry to solve practical problems.</b> <b>4.12.8 Use tools, technology, and models to sketch, draw, and construct geometric figures in order to solve problems and to demonstrate the properties of geometric figures.</b> <b>6.1 Select, modify, develop, and apply strategies to solve a variety of mathematical and practical problems and to investigate and understand mathematical concepts.</b>

Performance Indicators	Academic Standards
	<b>6.2 Apply previous experience and knowledge to new problem-solving situations.</b> <b>6.9 Generalize solutions and strategies from earlier problems to new problem situations.</b> <b>9.7 Apply mathematical thinking and modeling to solve problems that arise in other disciplines.</b> <b>9.8 Identify, explain, and use mathematics in everyday life.</b>
<b>6.3.2</b>	<u>English</u> <b>7.12.5 Demonstrate conventional spelling.</b>

Content Standard 7.0: Students will identify and safely operate machine tools commonly used in the metalworking lab.

Performance Indicators	Academic Standards
<b>7.1.2</b>	<u>Science</u> <b>23.12.2 Use algebraic equations when appropriate.</b>
<b>7.1.4, 7.1.5</b>	<u>Math</u> <b>3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass.</b> <b>3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations.</b> <b>3.12.5 Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems.</b> <u>Science</u> <b>24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.</b>
<b>7.2.2</b>	<u>Science</u> <b>24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.</b>
<b>7.2.3</b>	<u>Science</u> <b>23.12.2 Use algebraic equations when appropriate.</b>
<b>7.2.5</b>	<u>Math</u> <b>3.12.2 Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass.</b> <b>3.12.3 Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations.</b> <b>3.12.5 Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems.</b> <u>Science</u> <b>24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.</b>
<b>7.3.6</b>	<u>Science</u> <b>24.12.1 Demonstrate personal responsibility for using safety equipment and observing all safety standards.</b>

Content Standard 8.0: Students shall achieve competence in workplace readiness, career development, and lifelong learning.

Performance Indicators	Academic Standards
8.1.1, 8.1.2	<u>English</u> 10.12.2 Negotiate to arrive at consensus by proposing and examining possible options. 10.12.3 Identify and practice techniques such as setting time limits for speakers and deadlines for decision making to improve productivity of group discussion.
8.2.2	<u>English</u> 10.12.1 Participate in problem-solving conversations or group discussions by identifying, synthesizing, and evaluating data.
8.3.6	<u>English</u> 4.12.6 Read and apply multi-step directions in order to perform complex procedures and tasks.
8.3.8	<u>English</u> 6.12.5 Edit for use of standard English. 7.12.1 Apply the rules of usage, grammar, and capitalization with few significant errors; use modifiers, parallel structure, and subordination correctly in writing. 7.12.3 Use rules of punctuation; manipulate conventions for emphasis in writing. 7.12.4 Use rules of capitalization. 7.12.5 Demonstrate conventional spelling.
8.8.1	<u>English</u> 6.12.5 Edit for use of standard English.
8.8.2	<u>English</u> 7.12.3 Use rules of punctuation; manipulate conventions for emphasis in writing.
8.8.3	<u>English</u> 5.12.5 Write summaries or abstracts that distill large amounts of information into clear, concise prose. 7.12.4 Use rules of capitalization.
8.8.4	<u>English</u> 7.12.5 Demonstrate conventional spelling. 9.12.1 Use specific and varied vocabulary and apply standard English to communicate ideas.
8.8.5	<u>English</u> 7.12.1 Apply the rules of usage, grammar, and capitalization with few significant errors; use modifiers, parallel structure, and subordination correctly in writing.