

Curriculum Framework

A Reference Guide for the Metals Technology Career Pathway

**Albuquerque Public Schools
Career Technical Education
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CAREER AND TECHNICAL EDUCATION

Career and Technical Education (CTE), a formal part of American education since the first federal vocational education law was passed in 1917, is proactively responding to an educational reform agenda and to a changing national and global economy. CTE now is increasingly linked to high academic standards as well as particularly responsive to our nation's need for a labor force prepared with the diverse skills required for our knowledge-based economy. CTE provides relevant experiences and enhances opportunities for learning, careers, and further education.

PURPOSE OF THIS GUIDE

The goal of this guide is to provide an integrated curriculum framework that blends the learning and performance expectations in the Production Career Pathway with New Mexico core academic standards and expected workforce skills.

This guide contains:

- [Course descriptions](#) for each course offered within Metals Technology
- [Foundation Standards](#), with core academic standards and skills necessary for all courses offered in Metals Technology, and
- [Pathway Standards](#) and [Assessment Illustrations](#) specific to each course.

METALS TECHNOLOGY CAREER PATHWAY

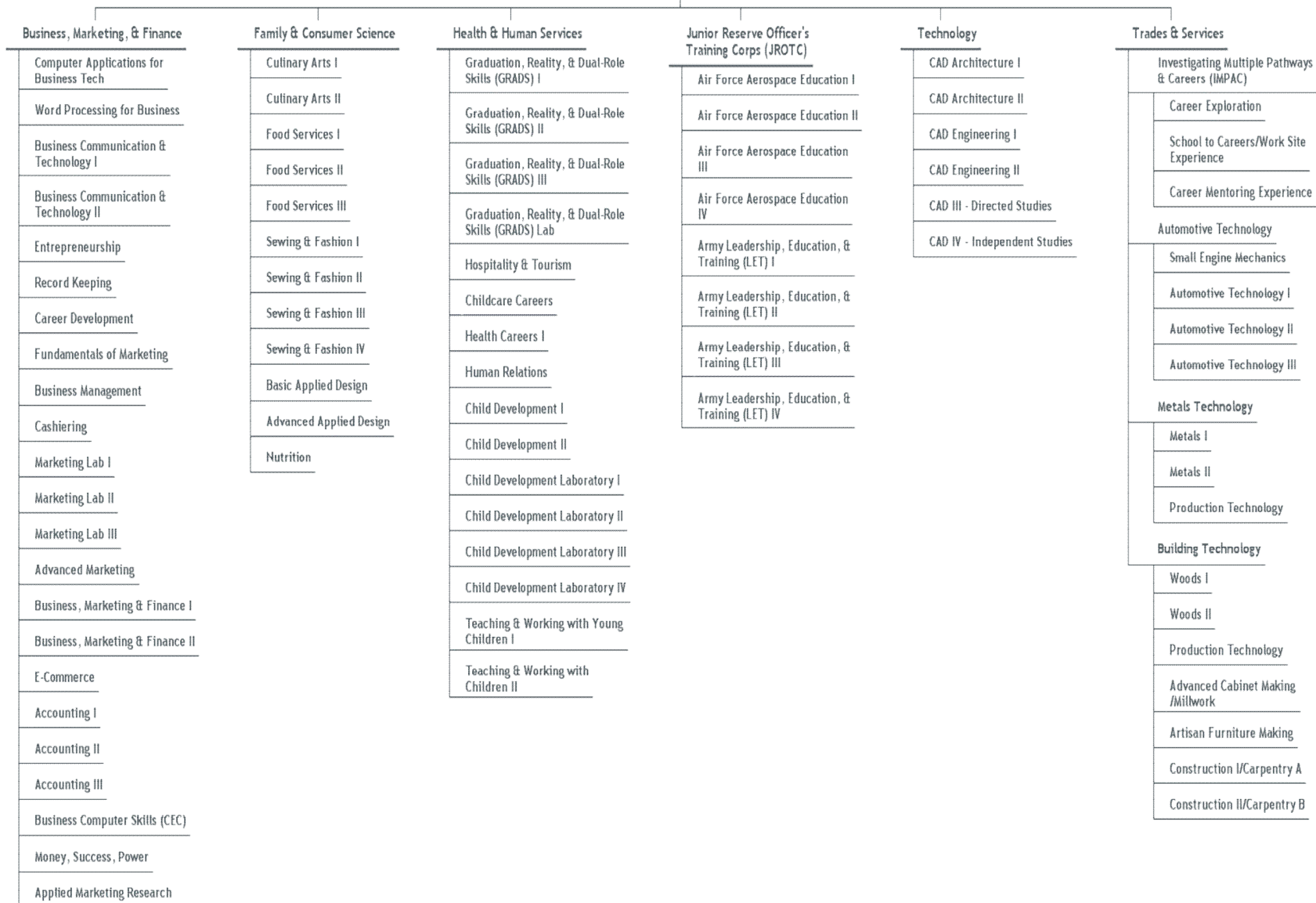
The Production Career Pathway is designed to provide a foundation in metals technology for students in the Albuquerque Public Schools. The pathway emphasizes real-world, occupationally relevant experiences of significant scope and depth. The standards are designed to integrate academic and technical preparation with a focus on career awareness, career exploration, and skill preparation. Integral components include classroom, laboratory, contextual learning, and project- and work-based instruction as well as internship, community classroom, cooperative career technical education, and leadership development. The standards prepare students for continued training, postsecondary education, and entry to a career. The courses include:

Metals I teaches students processing, properties forming, fastening, and finishing of metals. Areas of study are safety, material identification and application, measurement, design, planning, and layout, hand and power tools, metal processing machines, assembly, and career pathway and employment skills.

Metals II is designed so that students continue to build the skills developed in Metals 1. The student studies machine tool and welding processes that are used in the trades and develops skills in machining and welding. Areas of study are safety, material identification and application, measurement, design, planning, and layout, hand and power tools, metal processing machines, assembly, and career pathways and employment skills.

Production Technology – Directed Studies provides a student with individual study in an area of advanced metal working. The student assumes responsibility for identifying, pursuing, and culminating an activity that expands knowledge about some phase of industry. An individual plan is required to be approved by the instructor, parent/guardian, student, and school administrator. This course may be a TVI articulated/concurrent enrollment course.

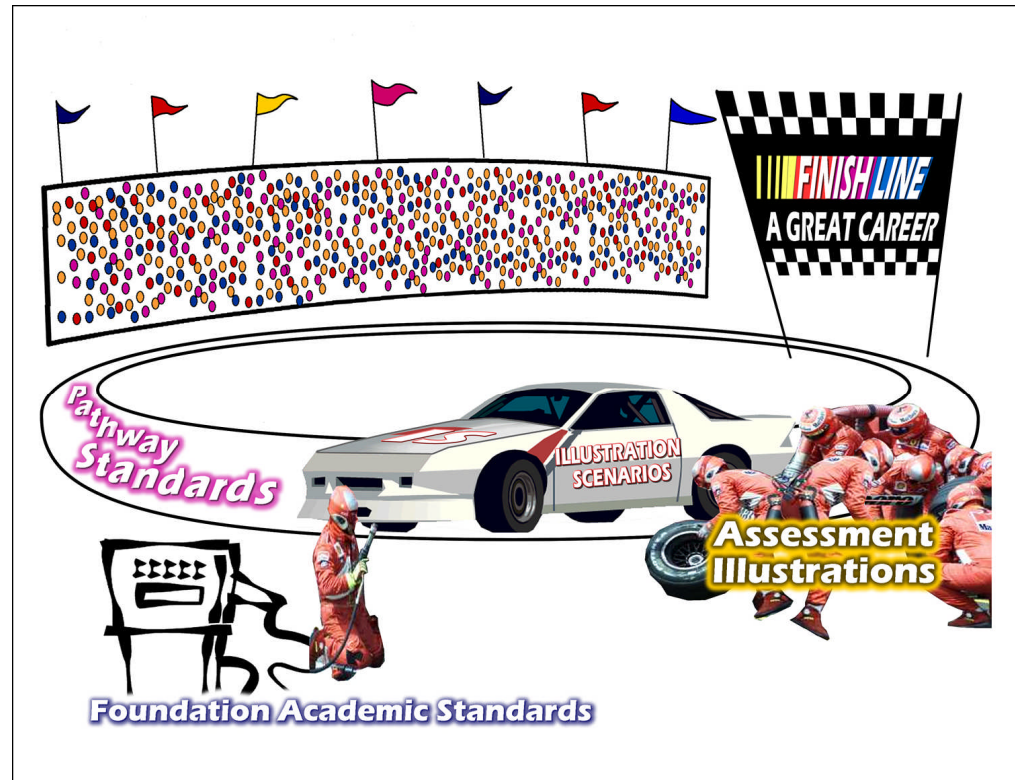
Career and Technical Education Pathways



Understanding the Relationship Between: Foundation Standards, Pathway Standards Assessment Illustrations, and Integration Scenarios

In understanding how these components relate to each other, consider this:

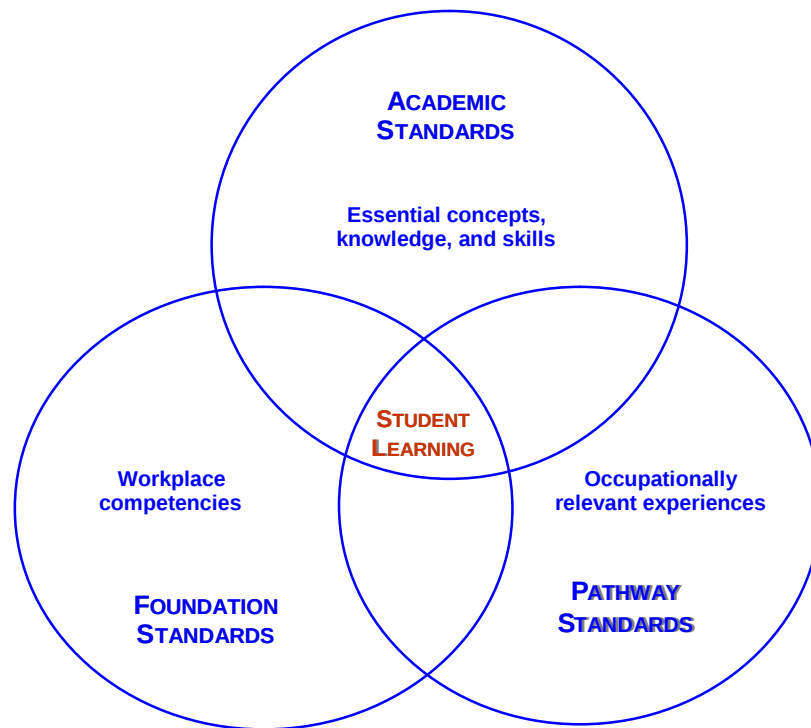
- The **pathway standards** are the track, or super-highway, providing the most direct route between where a student currently is (in school) and their ultimate destination (an engaging and productive career).
- The **illustration scenarios** (or lessons) are the vehicle that moves the student along the track, or highway, and gives students hands on experience in their chosen program of study.
- The **assessment illustrations** are the diagnostics, and instructors use the assessments provided, augmented by their own understanding and any assessment tools they create, to determine where a student is on the track and how ably and quickly they are moving toward the finish line.



- Most importantly, the **foundation standards** are the fuel. The foundation standards, which include the core academic standards, enable students to be successful in their chosen program of study.

Metals Technology Framework

Career and Technical Education (CTE) students need to master certain workplace skills. The Secretary's Commission on Achieving Necessary Skills (SCANS) calls these essentials "foundation skills" because they prepare students to master workplace competencies both within the curriculum and in the workplace. These foundation standards are common to all of the Albuquerque Public Schools' CTE clusters.



The Production Career Pathway Foundation Standards include critical New Mexico Academic Content Standards.

The following three tabs contain these critical academic standards, and are labeled:

- Mathematics Content Standards,
- Science Content Standards, and
- Language Arts Content Standards.

The remaining Foundation Standards are found under the Workforce Skills tab.

The Foundation Standards include workplace competencies. The Core Academic Standards articulate essential concepts, knowledge, and skills. The Pathway Standards contain occupationally relevant materials. When integrated, these three components intersect, creating relevant and successful student learning.

Mathematics Academic Content Standards

1.0 Academics

Students understand the academic content required for entry into postsecondary education and employment within the metals industry.

The **critical mathematics standards** that build a foundation under the Metals Technology Career Pathway are:

- CMS 1: **Perform arithmetic operations and their inverses (e.g., addition/subtraction, multiplication/division, square roots of perfect squares, cube roots of perfect cubes) on real numbers.**
(Reference: Mathematics Grade 8, Strand Numbers and Operations, Benchmark Understand the meaning of operations and know how they relate to one another, Performance Standard 2).
- CMS 2: **Perform conversions with multiple terms between metric and U.S. standard measurement systems.**
(Reference: Mathematics Grade 8, Strand Measurement, Benchmark Apply appropriate techniques, tools, and formulas to determine measurements, Performance Standard 5).
- CMS 3: **Develop an appropriate strategy using a variety of data from surveys, samplings, estimations, and inferences to address a specific problem.**
Reference: Mathematics Grade 8, Strand Measurement, Benchmark, Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, Performance Standard 6).
- CMS 4: **Demonstrate understanding of the relationships between ratios, proportions, and percents and solve for a missing term in a proportion.**
(Reference: Mathematics Grade 8, Strand Algebra, Benchmark Represent and analyze mathematical situations and structures using algebraic symbols, Performance Standard 4).
- CMS 5: **Generate different representations to model a specific numerical relationship given one representation of data.**
(Reference: Mathematics Grade 8, Strand Algebra, Benchmark Use mathematical models to represent and understand quantitative relationships, Performance Standard 1).
- CMS 6: **Use a variety of computational methods (e.g. mental arithmetic, paper and pencil, technological tools).**
(Reference: Mathematics Grade 9-12 Strand Algebra, Functions, Graphs Benchmark Use mathematical models to represent and understand quantitative relationships, Performance Standard, 12).
- CMS 7: **Generate an algebraic sentence to model real-life situations.**
(Reference: Mathematics Grade 9-12 Strand Algebra, Functions, Graphs, Benchmark Use mathematical models to represent and understand quantitative relationships, Performance Standard 9).

- CMS 8: **Interpret and draw two-dimensional objects and find the area and perimeter of basic figures (e.g., rectangles, circles, triangles, other polygons [e.g., rhombi, parallelograms, trapezoids]).**
(Reference: Mathematics Grade 9-12, Strand Geometry and Trigonometry, Benchmark Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships, Performance Standard 1.)
- CMS 9: **Solve problems using the Pythagorean theorem (e.g., "Given the length of a ladder and the distance of the base of the ladder from a wall, determine the distance up the wall to the top of the ladder.")**
(Reference: Mathematics Grade 9-12 Strand Geometry and Trigonometry, Benchmark Use visualization, spatial reasoning, and geometric modeling to solve problem, Performance Standard 4).
- CMS 10: **Solve real-world problems using congruence and similarity relationships of triangles (e.g., find the height of a pole given the length of its shadow).**
(Reference: Mathematics Grade 9-12 Strand Geometry and Trigonometry, Benchmark Use visualization, spatial reasoning, and geometric modeling to solve problem, Performance Standard 1).
- CMS 11: **Know and use angle and side relationships in problems with special right triangles (e.g., 30-, 45-, 60-, and 90-degree triangles).**
(Reference: Mathematics Grade 9-12 Strand Geometry and Trigonometry, Benchmark Use visualization, spatial reasoning, and geometric modeling to solve problem, Performance Standard 7).
- CMS 12: **Understand the differences between the various methods of data collection.**
(Reference: Mathematics Grade 9-12 Strand Data Analysis and Probability, Benchmark Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them, Performance Standard 1).
- CMS 13: **Understand the meaning of measurement data and categorical data, and of the term "variable".**
(Reference: Mathematics Grade 9-12 Strand Data Analysis and Probability, Benchmark Select and use appropriate statistical methods to analyze data, Performance Standard, 1).

Science Academic Content Standards

1.0 Academics

Students understand the academic content required for entry into postsecondary education and employment within the metals industry.

The **critical science standards** that build a foundation for the Metals Technology Pathway in Grades 9-12 are:

CSS 1: Design and conduct scientific investigations that include: testable hypothesis, controls and variables, methods to collect, analyze, and interpret data, results that address hypotheses being investigated, predictions based on results, re-evaluation of hypotheses and additional experimentation as necessary, and error analysis.

(Reference: Science Grade 9-12, Strand: Scientific Thinking and Practice, Benchmark, Use accepted scientific methods to collect, analyze, and interpret data and observations and to design and conduct scientific investigations and communicate results, Performance Standard 2).

CSS 2: Use appropriate technologies to collect, analyze, and communicate scientific data.

(Reference: Science Grade 9-12, Strand: Scientific Thinking and Practice, Benchmark, Use accepted scientific methods to collect, analyze, and interpret data and observations and to design and conduct scientific investigations and communicate results, Performance Standard 3).

CSS 3: Create models to describe phenomena.

(Reference: Science Grade 8, Strand: Scientific Thinking and Practice, Benchmark, Use mathematical ideas, tools, and techniques to understand scientific knowledge, Performance Standard 2).

CSS 4: Identify and apply measurement techniques and consider possible effects of measurement errors.

(Reference: Science Grade 9-12, Strand: Scientific Thinking and Practice, Benchmark, Use mathematical concepts, principles, and expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions, Performance Standard 4).

CSS 5: Distinguish between metals and non-metals.

(Reference: Science Grade 8, Strand: Content of Science (Physical Science), Benchmark, Know the forms and properties of matter and how matter interacts, Performance Standard, Properties of Matter, 2).

CSS 6: Identify factors that influence the rate at which chemical reactions occur.

(Reference: Science Grade 8, Strand: Content of Science (Physical Science), Benchmark, Know the forms and properties of matter and how matter interacts, Performance Standard, Changes in Matter, 9).

- CSS 7: **Identify, measure, and use a variety of physical and chemical properties (e.g., electrical conductivity, density, viscosity, chemical reactivity, pH, melting point).**
(Reference: Science Grade 9-12, Strand: Content of Science (Physical Science), Benchmark, Understand the properties, underlying structure, and reactions of matter, Performance Standard (Properties of Matter) 2).
- CSS 8: **Know that chemical reactions involve the rearrangement of atoms, and that they occur on many timescales (e.g., picoseconds to millennia).**
(Reference: Science Grade 9-12, Strand: Content of Science (Physical Science), Benchmark, Understand the properties, underlying structure, and reactions of matter, Performance Standard, Changes in Matter, 12).
- CSS 9: **Know that electrical energy is the flow of electrons through electrical conductors that connect sources of electrical energy to points of use, including: electrical current paths through parallel and series circuits, production of electricity, use of electricity by appliances and equipment.**
(Reference: Science Grade 8, Strand Content of Science (Physical Science), Benchmark, Explain the physical processes involved in the transfer, change, and conservation of energy, Performance Standard (Energy Transformation) 4).
- CSS 10: **Create multiple displays of data to analyze and explain relationships in scientific investigations.**
(Reference: Science Grade 9-12, Strand Scientific Thinking and Practice, Benchmark, Use mathematical concepts, principles, and expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions, Performance Standard 4).
- CSS 11: **Evaluate the influences of technology on society.**
(Reference: Science Strand: Science and Society, Benchmark, Examine and analyze how scientific discoveries and their applications affect the world, and explain how societies influence scientific investigations and applications, Performance Standard 3). (Reference: Science Grade 8, Strand: Content of Science (Physical Science), Benchmark, Know the forms and properties of matter and how matter interacts, Performance Standard, Changes in Matter, 9).
- CSS 12: **Describe the essential components of an investigation, including appropriate methodologies, proper equipment, and safety precautions.**
(Reference: Science Grade 9-12, Strand Scientific Thinking and Practice, Benchmark, Use accepted scientific method to collect, analyze, and interpret data and observations to design and conduct scientific investigations and communicate results, Performance Standard, 1).

Language Arts Academic Content Standards

2.0 Communication

Students understand the principles of effective oral, written, and multimedia communication in a variety of formats and contents.

The **critical language arts standards** that build a foundation for the Metals Technology Pathway are:

CLAS 1: Respond to informational texts by using a variety of strategies for preparation, engagement, and reflection; paraphrasing main ideas and supporting details.

(Reference: Language Arts Grade 11, Strand: Reading and Listening for Comprehension, Benchmark, Listen to, read, react to, and analyze information, Performance Standard 3).

CLAS 2: Evaluate the information, explanations, or ideas of others by identifying clear, reasonable criteria for evaluation applying those criteria using reasoning and substantiation.

(Reference: Language Arts Grade 10, Strand: Reading and Listening for Comprehension, Benchmark, Listen to, read, react to, and analyze information, Performance Standard 4).

CLAS 3: Use multiple resources to gather information to evaluate problems, examine cause and effect relationships, and answer research questions to inform an audience.

(Reference: Language Arts Grade 10, Strand: Reading and Listening for Comprehension, Benchmark, Synthesize and evaluate information to solve problems across the curriculum, Performance Standard 3).

CLAS 4: Demonstrate proficiency in accessing and sending information electronically.

(Reference: Language Arts Grade 11, Strand: Reading and Listening for Comprehension, Benchmark, Synthesize and evaluate information to solve problems across the curriculum, Performance Standard 4).

CLAS 5: Accurately interpret information from and detect inconsistencies in a variety of informational, literary, and technical texts.

(Reference: Language arts Grade 9, Strand: Reading and Listening for Comprehension, Benchmark, Apply knowledge of reading process to evaluate print, non-print, and technology-based information, Performance Standard 3).

CLAS 6: Accurately interpret information presented in a technical format (e.g., charts, diagrams, tables).

(Reference: Language Arts Grade 11, Strand: Reading and Listening for Comprehension, Benchmark, Apply knowledge of reading process to evaluate print, non-print, and technology-based information, Performance Standard 5).

CLAS 7: Synthesize and organize information from a variety of sources in order to inform and persuade an audience.

(Reference: Language Arts Grade 11, Strand: Speaking and Writing for Expression, Benchmark Demonstrate competence in the skills and strategies of the writing process, Performance Standard 2).

- CLAS 8: **Read critically and independently to draw conclusions from research.**
(Reference: Language Arts Grade 10, Strand: Reading and Listening for Comprehension, Benchmark, Demonstrate critical thinking skills to evaluate information and solve problems, Performance Standard 5).
- CLAS 9: **Use a variety of technology tools to present information appropriate for the purpose and audience.**
(Reference: Language Arts Grade 11, Strand: Speaking and Writing for Expression, Benchmark, Apply grammatical and language conventions to communicate, Performance Standard 2).
- CLAS 10: **Make well-informed and well-organized formal presentations with a clear main point, adjusting the message, wording, and delivery to the particular audience and context.**
(Reference: Language Arts Grade 10, Strand: Writing and Speaking for Expression, Benchmark, Communicate information in a coherent and persuasive manner using verbal and non-verbal language, Performance Standard 2).

Workforce Skills Foundation Standards

The critical workforce skills that build a foundation for the Production Career Pathway are:

3.0 Career Planning and Management

Students understand how to make effective decisions, use career information, and manage personal career plans, and:

- 3.1 Know the personal qualifications, interests, aptitudes, knowledge, and skills necessary to succeed in careers.
- 3.2 Understand the scope of career opportunities and know the requirements for education, training, and licensure.
- 3.3 Develop a career plan that is designed to reflect career interests, pathways, and postsecondary education.
- 3.4 Understand the role and function of professional organizations, industry associations, and organized labor in a productive society.
- 3.5 Understand the past, present, and future trends that affect careers, such as technological developments and societal trends, and the resulting need for life-long learning.
- 3.6 Know key strategies for self-promotion in the hiring process, such as job applications, résumé writing, interviewing skills, and portfolio preparation.

4.0 Technology

Students know how to use contemporary and emerging technological resources in diverse and changing personal, community, and workplace environments, and:

- 4.1 Understand the influence of current and emerging technologies as they relate to the metals industry.
- 4.2 Understand the use of technological resources to access, manipulate, and produce information, products, and services.
- 4.3 Understand the influence of current and emerging technologies on selected segments of the economy.
- 4.4 Understand the role and function of state-of-the art tools, equipment, and machines in use in the industry.
- 4.5 Know key aspects of the current economy and labor market, including the type of good and services produced, the type of skills workers need, the effects of rapid technological change, and the impact of international competition.

5.0 Problem Solving and Critical Thinking

Students understand how to create alternative solutions by using critical and creative thinking skills, such as logical reasoning, analytical thinking, and problem-solving techniques, and:

- 5.1 Apply appropriate problem-solving strategies and critical thinking skills to work-related issues and tasks.
- 5.2 Understand the systematic problem-solving models that incorporate input, process, outcome, and feedback components.
- 5.3 Use critical thinking skills to make information decisions and solve problems.
- 5.4 Understand and demonstrate the ability to plan and solve problems in a systematic manner and apply the learned skill to real-world problems.

6.0 Health and Safety

Students understand health and safety policies, procedures, regulations, and practices, including equipment and hazardous material handling, and:

- 6.1 Know policies, procedures, and regulations regarding health and safety in the workplace, including employers' and employees' responsibilities.
- 6.2 Understand critical elements for health and safety practices related to storing cleaning, and maintaining tools, equipment, and supplies.

- 6.3 Use tools, equipment, and machinery safely and appropriately.
- 6.4 Know local, state, and federal laws, and the requirements of regulatory agencies, that affect the industry.

7.0 Responsibility and Flexibility

Students know the behaviors associated with the demonstration of responsibility and flexibility in personal, workplace, and community settings, and:

- 7.1 Understand the qualities and behaviors that constitute a positive and professional work demeanor.
- 7.2 Understand the importance of accountability and responsibility in fulfilling personal, community, and workplace roles.
- 7.3 Understand the need to adapt to varied roles and responsibilities.
- 7.4 Understand that individual actions can affect the larger community.

8.0 Ethics and Legal Responsibilities

Students understand professional, ethical, and legal behavior consistent with applicable laws, regulations, and organizational norms, and:

- 8.1 Know major local, district, state, and federal regulatory agencies and entities that affect industry and how they enforce laws and regulations.
- 8.2 Understand the concept and application of ethical and legal behavior consistent with workplace standards.
- 8.3 Understand the role of personal integrity and ethical behavior in the workplace.

9.0 Leadership and Teamwork

Students understand effective leadership styles, key concepts of group dynamics, team and individual decision making, the benefits of workforce diversity, and conflict resolution, and:

- 9.1 Understand the characteristics and benefits of teamwork, leadership, and citizenship in the school, community, and workplace setting.
- 9.2 Understand the ways in which pre-professional associations and competitive career development activities enhance academic skills, promote career choices, and contribute to employability.
- 9.3 Understand how to organize and structure work individually and in teams for effective performance and attainment of goals.
- 9.4 Know multiple approaches to conflict resolution and their appropriateness for a variety of situations in the workplace.
- 9.5 Understand how to interact with others in ways that demonstrate respect for a variety of situations in the workplace.
- 9.6 Participate as a member of a team and contribute to a group effort.

10.0 Technical Knowledge and Skills

Students understand the essential knowledge and skills common to all pathways in the Trades and Services sector, and:

- 10.1 Operate, maintain, and troubleshoot equipment.
- 10.2 Understand how to select and use information and communication technologies.
- 10.3 Understand the need to participate in sector-related professional improvement activities related to career pathway specialization.
- 10.4 Understand the need to obtain and maintain industry-standard, technical certifications significant to an industry sector.

11.0 Demonstration and Application

Students demonstrate and apply the concepts contained in the foundation and pathway standards.

Metals I: Pathway Standards

Metals I teaches students processing, properties forming, fastening, and finishing of metals. Areas of study are safety, material identification and application, measurement, design, planning, and layout, hand and power tools, metal processing machines, assembly, and career pathway and employment skills.

Course components include activities that follow guidelines of the New Mexico Career Readiness (CR), Work Keys (WK), Work Site Programs Standards Manual (WSPSM), and critical NM mathematics (CMS), science (CSS), and language arts (CLAS) academic content standards.

STRAND I: SAFETY

CONTENT STANDARD: *The student evaluates information, explains, and applies reasonable criteria (CLA 2) for the safe use of equipment and shop practices.*

- A. The student develops and demonstrates proficiency in shop safety and practice in completion of all required activities.
 - 1. Exhibits safe tool and machine usage and passes a certification test as a 100% level (CR: 4D).
 - 2. Identifies individual responsibilities and personal traits of safe work habits (CR: 4D).
 - 3. Demonstrates the use and care of appropriate protective equipment (WK).
 - 4. Exhibits proper material handling (e.g., oversized material, lifting, chemicals, and electrical hazards) (WK, CR: 4E).
 - 5. Knows, can explain, and practices fire prevention and fire safety procedures (CR: 4D).
 - 6. Demonstrates responsible behavior related to safety issues (CR: 4A, 4D, 4E).
 - 7. Operates safely in a machine shop and welding environment (CR: 4D).

STRAND II: MATERIAL IDENTIFICATION AND APPLICATION

CONTENT STANDARD: *The student uses multiple resources to gather information (CLA 3) to identify metals, evaluates the information and explanations (CLA 2) that describes their applications, and examines cause and effect relationships (CLA 3).*

- B. The student explores the different types of hot and cold metal properties and working processes.
 - 1. Demonstrates familiarity with origins of metals, properties, and alloying (WK).
 - 2. Identifies metals by color, weight, size, shape, and application (CSS 5, 7, WK).
 - 3. Selects and uses the appropriate materials, technologies (CSS 2), and measurement techniques (CSS 4) to complete a project (CR: 3A).

STRAND III: MEASUREMENT

CONTENT STANDARD: *The student uses measuring instruments to build and evaluate projects and to interpret prints/drawings.*

- C. The student demonstrates use of measuring instruments and techniques (CSS 4) to acceptable tolerances.
 - 1. Performs arithmetic operations (CMS 1) and conversions with multiple terms between metric and US standard measurement systems (CMS 2) within acceptable tolerances (WK).
 - 2. Applies knowledge of arithmetic operations (CMS 1) and conversions (CMS 2) in the use of decimal inch with dial calipers, micrometers, and scales (WK).
 - 3. Performs basic operations (CMS 1) using whole numbers, fractions, and decimals (WK).

4. Uses multiple displays of data (CSS, 10, CMS 3) and models numerical relationships (CMS 5) to read and accurately interpret (CLAS 5, 6) operational and technical documents (e.g., blueprints) (WK, CR; 1D).

STRAND IV: DESIGN, PLAN, LAYOUT

CONTENT STANDARD: *The student interprets and implements proper procedures and problem solving techniques related to proper completion of projects.*

- D. The student successfully completes a project using proper procedures and techniques.
 1. Uses data and numerical relationships (CMS 5), computational methods (CMS 6), and geometric relationships (CMS 8, 12) to design a sheet metal project that represents a real-world problem (CMS 11, CSS 1, CR: 1D).
 2. Uses information text and criteria for evaluating information with multiple resources to design a sheet metal project (CLAS 1, 2, 3).
 3. Uses ratios and proportions (CMS 4) and a variety of computations methods (CMS 6), including two dimensional objects (CMS 8) to draw a project using appropriate technology (CLAS 9) to specifications (CR: 1D).
 4. Performs mathematical conversions (CMS 2), uses a variety of computation methods (CMS 6), and accurately interprets technical information (CLAS 5, 6) to apply layout to actual material within acceptable tolerances (CR: 1D, 2C).
 5. Understands physical properties of metals (CSS 7) and demonstrates efficient use of materials (CRL 1D, 2C).
 6. Follows materials list for course project (CR: 2C).

STRAND V: HAND TOOLS/POWER TOOLS

CONTENT STANDARD: *The student understands the proper use and application of hand and power tools.*

- E. The student responds to informational texts (CLAS 1) and accurately interprets technical information (CLAS 5, 6) to properly use and maintain hand, power, and machine tools (CSS 12).
 1. Identifies the hand/hand held power tools that are used by metal workers (WK, CRL 1D).
 2. Selects the appropriate hand/hand held tool to complete a project (WK, CR: 1D).
 3. Demonstrates the safe use and care of hand/hand held power tools (WK, CR: 4D).

STRAND VI: METAL PROCESSING MACHINES

CONTENT STANDARD: *The student understands the proper use and application of a variety of metal processing machines.*

- F. The student understands electrical conductivity (CSS 9) and exhibits proper use and maintenance of metal processing machines (e.g., machine tools, welding machines, sheet metal equipment, and foundry equipment).
 1. Demonstrates machine safety practices (WK, CR: 4D).
 2. Applies machine usage to project (WK).
 3. Uses machines in combination with each other to produce a project (WK).
 4. Uses and evaluates (CLAS 2) technical information from a variety of print sources (CLAS 1, 3) as a resource to provide background information on each piece of equipment (WK, CR: 3A).
 5. Utilizes electronic sources (CLAS 4) to recognize other related technological machines not found in the classroom (CR: #a).
 6. Gains introductory working knowledge, including the meaning of measurement data (CMS 13), and procedures in foundry operations, sheet metal operations, welding techniques, and metal fabrication techniques (CR: 1E).

STRAND VII: ASSEMBLY

CONTENT STANDARD: *The student demonstrates understanding of assembly procedures.*

- G. The student identifies and applies appropriate technologies (CSS 2), uses measurement techniques (CSS 4), and proper assembling techniques.
 - 1. Understands physical and chemical properties (CSS 7) to assemble metal plates using the welding processes (WK, CR: 1D).
 - 2. Demonstrates proper use of fasteners (e.g., nuts, bolts, and rivets) (WK, CR: 1D).

STRAND VIII: CAREER PATHWAYS AND EMPLOYMENT SKILLS

CONTENT STANDARD: *The student explores career pathways and had knowledge of skills necessary to seek employment.*

- H. The student recognizes and expresses interest in career opportunities and expectations of the industry.
 - 1. Explores career opportunities in the welding field (CR: 1A), WSPSM).
 - 2. Responds and evaluates information text and uses multiple print and electronic resources to read critically and draw conclusions about (CLAS 1, 2, 3, 4, 5, 6, 8) employability skills (CR: 4C, WSPSM).
 - a. Collaborates and cooperates with other students
 - b. Completes assigned tasks in a timely manner
 - c. Demonstrates positive behavior in the classroom
 - d. Follows directions
 - e. Uses technology (CLAS 9) to synthesize, organize, and present information (CLAS 7, 10) to communicate effectively in both oral and written forms,
 - f. Uses and understands data and methods of data collection (CMA 3, 13) to solve problems and thinks critically
 - 3. Recognizes levels of education and training needed for career positions (CR: 1A, 1C, 3C).
 - 4. Develops responsible awareness of related environmental concerns (CR; 4E).
 - 5. Evaluates the influences of technology on society (CSS 11) and the metals industry.

Metals I: Assessment Illustrations

Note: These assessment illustrations include suggested activities for attaining each performance standard, with at least one key feature to look for while assessing student performance. A check (✓) refers to a key feature to look for while assessing student performance.

STRAND I: SAFETY

CONTENT STANDARD: *The student exhibits the safe use of equipment and shop practices.*

- 1-3,6 The student studies the safety data sheets for each machine and demonstrates proficiency on each machine under teacher supervision. After a teacher demonstration, and before the student demonstrates proficiency on the machine, the student takes a safety test relevant to that machine. The results are kept on file for liability purposes.
- ✓ Safety procedures
 - ✓ correct use of tools
 - ✓ appropriate behavior
4. The student demonstrates safe and proper material handling during the construction of a project that has been approved by the instructor.
- ✓ safety practices
5. The student identifies locations of all fire extinguishers and exits.
- ✓ correct identification of locations and exits

STRAND II: MATERIAL IDENTIFICATION AND APPLICATION

CONTENT STANDARD: *The student identifies metals and describes their applications.*

- 1-2. Either orally or in written form, the student identifies the most commonly used metals and describes their properties (e.g., ferrous, nonferrous) on a test.
- ✓ correct identification of metals
3. The student selects a project (with instructor approval) and completes an assigned activity utilizing the appropriate materials.
- ✓ completion of project
 - ✓ quality of project
 - ✓ safety practices
 - ✓ correct metals usage

Group Activity

The class is divided into five groups. Each group is given a box with 15 identical metal and non-metal items. The assignment is to create a hierarchy to classify all items and prepare a report and communicate findings to the entire class. Students must provide descriptions of all materials based on properties (e.g., density, brittleness, weight).

STRAND III: MEASUREMENT

CONTENT STANDARD: *The student uses measuring instruments to build and evaluate projects and to interpret prints/drawings.*

1. The student takes and passes a written examination on both standard English and metric measurement systems.
 - ✓ accuracy
- 1-3. Using a variety of instruments (e.g., calipers, micrometers, rulers) the student measures objects in the classroom and records the results. The student either measures the objects in both English and metric units or converts a measurement from one system to another (e.g., inches to centimeters).
 - ✓ accuracy
4. The student designs and builds a project (e.g., aluminum and brass hammer, aluminum bars) using measurements from a simple print.
 - ✓ appropriate finish
 - ✓ correct measurements
 - ✓ acceptable tolerances

STRAND IV: DESIGN/PLAN/LAYOUT

CONTENT STANDARD: *The student interprets and implements proper procedures and problem solving techniques related to proper completion of projects.*

- 1, 2, 4-6. The student successfully completes the design of a sheet metal project. Included are a materials list with project costs and stretch out to transfer dimensions.
 - ✓ completion of project
 - ✓ accurate dimensions
 - ✓ correct cost calculations
 - ✓ efficiency
- 3-4. Using applicable operational and technical documents, the student lays out and cuts materials by choosing correct methods to make a project within acceptable tolerances.
 - ✓ acceptable tolerances
 - ✓ accuracy
 - ✓ application of layout techniques

STRAND V: HAND TOOLS/POWER TOOLS

CONTENT STANDARD: *The student understands the proper use and application of hand and power tools.*

- 1-3. Using a variety of tools (e.g., hammer, grinder, files, drills) the student names the tool, describes the function of it, and in some cases, demonstrates the use of it.
 - ✓ accurate identification of tools and functions
 - ✓ appropriate handling

STRAND VI: METAL PROCESSING MACHINES

CONTENT STANDARD: *The student understands the proper use and application of a variety of metal processing machines.*

1. After the instructor demonstrates equipment capabilities for a machine group, the student studies the safety data sheets and takes a test on the machine group demonstrated. This practice is repeated for each machine group the student is required to learn.
 - ✓ comprehension
 - ✓ accuracy
- 2, 3, 6. After the teacher demonstrates a particular procedure (e.g., good bead vs. a bad bead), the student practices the procedure.
 - ✓ finish, size, and tolerances
 - ✓ uniform bead appearance
 - ✓ correct tool usage
 - ✓ use of a combination of tools
4. Because many students are new to the shop environment or have not yet passed the safety tests to work on machines, the student fills out worksheets using the textbook for guide in answering questions or completing drawings and outlines.
 - ✓ completion of work assignments
 - ✓ accuracy
5. Through videos and other supplements, the student gains exposure to other technological tools and equipment not found in the classroom and/or school shop. The student participates in class discussions relating what was seen in the videos to possible future practices.
 - ✓ individual participation
 - ✓ awareness

STRAND VII: ASSEMBLY

CONTENT STANDARD: *The student demonstrates understanding of assembly processes.*

1. The student fits up and welds the following in a flat position: butt weld, lap weld, tee weld, and edge weld.
 - ✓ correct assembly processes
2. The student threads hammer, handle, and drills and taps hammer head.
 - ✓ tolerances
 - ✓ fits
 - ✓ functionality OR
3. The student assembles sheet metal using rivet, soldering, and spot welding.
 - ✓ full penetration
 - ✓ enough current
 - ✓ functionality
 - ✓ properly formed

STRAND VIII: CAREER PATHWAYS AND EMPLOYMENT SKILLS

CONTENT STANDARD: *The student explores career pathways and has knowledge of skills necessary to seek employment.*

1. The student participates in a field trip to a metal fabrication business. If for whatever reasons the school cannot fund or provide the means for the field trip, the student learns about careers in the welding field through videos and research and discusses with the class new insights.
 - ✓ active participation
2. Throughout the year, the student follows proper décor in all classroom and shop activities that s/he is engaged in.
 - ✓ appropriate behaviors
 - ✓ completion of assignments
 - ✓ teamwork
 - ✓ effective communication
3. The student listens attentively to guest speakers brought in from the community or trade schools to talk about related careers. The student prepares in advance relevant questions to ask the speakers and writes a summary of the lecture afterwards.
 - ✓ pertinent information (e.g., education, training)

Extension: The student learns about careers through individual discussions and conversations with the instructor and by posters that are displayed throughout the classroom.

4. The student reads specifically chosen selections (e.g., recycling, fluid handling) from the textbook and discusses the readings in either small or large groups.
 - ✓ comprehension

Metals II: Pathway Standards

Metals II is designed so that students continue to build the skills developed in Metals 1. The student studies machine tool and welding processes that are used in the trades and develops skills in machining and welding. Areas of study are safety, material identification and application, measurement, design, planning, and layout, hand and power tools, metal processing machines, assembly, and career pathways and employment skills.

Course components include activities that follow guidelines of the New Mexico Career Readiness (CR), Work Keys (WK), Work Site Programs Standards Manual (WSPSM), and critical NM mathematics (CMS), science (CSS), and language arts (CLAS) academic content standards..

STRAND I: SAFETY

CONTENT STANDARD: *The student exhibits the safe use of equipment and shop practices.*

- A. The student develops and demonstrates an understanding of appropriate methodologies, proper equipment, and safety precautions (CSS 12) in machine shop practice.
 - 1. Reads critically (CLAS 8) and understands information from a variety of sources (CLAS 7) to integrate safe tool and machine usage in all activities and passes a certification test at a 100% level (CR: 1E, 4D).
 - 2. Demonstrates individual responsibilities and personal traits of safe work habits (CR: 4A, 4C, 4D).
 - 3. Employs the use and care of appropriate personal protective equipment (CR: 4C, 4D).
 - 4. Exhibits proper material handling (e.g., oversized material, lifting, chemicals, electrical hazards (CR: 4D, 4E).
 - 5. Practices fire prevention and fire safety procedures (CR: 4D).
 - 6. Demonstrates responsible behavior related to safety issues (DR: 4D, 4E).
 - 7. Operates safely in a machine shop and welding environment (CR: 4D).

STRAND II: MATERIAL IDENTIFICATION AND APPLICATION

CONTENT STANDARD: *The student identifies metals and describes their application*

- B. The student identifies a broader range of metals and their application.
 - 1. Focuses on beginning metallurgy to understand physical properties of metals and non-metals (CSS 5, 7) (WK).
 - 2. Uses appropriate technologies and measurement techniques (CSS 2, 4)
 - 3. Understands two-dimensional objects, structured shapes and their applications to solve real world problems (CMS 10, 11, WK).
 - 4. Uses electronic information (CLAS 4) to integrate the appropriate materials and technology to complete a project.

STRAND III: MEASUREMENT

CONTENT STANDARD: *The student demonstrates the use of measuring instruments to find tolerances.*

- C. The student uses measuring instruments to build and evaluate advanced projects and to interpret advances prints/drawings (CSS 4).
 - 1. Performs arithmetic operations (CMS 1) and conversions (CMS 2) and accurately interprets technical information (CLAS 6) to measure to prescribed tolerances (CSS 7) (WK).
 - 2. Understands conversions with multiple terms (CMS 2) and recognizes and identifies precision measurement tools (e.g., micrometers larger than 1 inch) (WK).
 - 3. Applies geometrical concepts (e.g., triangles, Pythagorean Theorem) to solve problems (CMS 8, 9, 10, 11) (CMS 8, WK).

4. Uses ratio and proportion (CMS 4) to create models (CMS 5) and uses scales in drawings, both decimal inch and metrics (WK).
5. Converts units with a measuring system (e.g., feet to inches, meters to centimeters) (CMS 2, WK).
6. Develops models (CMS 5) that incorporate multiple displays of data (CSS 10) to build an advanced project that meet given tolerances and quality control standards (CR: 1E, 3C, 3D, 5F).
7. Uses multiple electronic resources to gather, interpret, and present information (CLAS 3, 4, 5, 6, 7).
8. Reads blueprints (CLAS 5, 6), uses computational methods (CMS 6), and interprets two-dimensional objects (CMS 8) to understand basic welding symbols (CR: 3C, 3D).
9. Accurately interprets technical information (CLAS 5, 6).

STRAND IV: DESIGN/PLAN/LAYOUT

CONTENT STANDARD: *The student interprets and implements proper procedures and problem solving techniques.*

- D. The student incorporates scientific methods of inquiry (CSS 1, 2, 4, 7, 10, 12) and successfully completes an advanced project.
 1. Demonstrates understanding of the relationships between ratios and proportions (CMS 4) to create a tolerance shoulder, diameter length (CR: 1D).
 2. Applies principles of design, with consideration of material and processes, to prepare specifications and plans (CR: 1E, 3C, 3D, 4E, 5E, 5F).
 3. Uses problem solving processes, including models of specific numerical relationship (CMS 5) and a variety of computation methods (CMS 6) to complete projects (CR: 5E, 5F0).
 4. Employs efficient use of materials (CR: 1D, 2C).
 5. Computes project costs by performing arithmetic operations (CMS 1, CR: 2C).
 6. Synthesizes and organizes information from a variety of sources (CLAS 7), reads critically (CLAS 8) and accurately interprets information presented in a technical format (CLAS 6).
 7. Prepares and follows materials list for course projects (CR: 2A, 2C).

STRAND V: HAND TOOLS/POWER TOOLS

CONTENT STANDARD: *The student demonstrates an advanced understanding of the proper use and application of hand/hand –held power tools.*

- E. The student demonstrates an understanding of the appropriate methodologies, proper equipment, safety precautions (CSS 12), and proper use and maintenance of hand and hand power tools.
 1. Selects and uses the appropriate hand/hand-held power tool to complete an advanced project (WK, CR: 1D).
 2. Incorporates the safe use and care of hand/hand-held power tools (WK, CR: 4D).
 3. Demonstrates proficiency in the safe manipulation of tools used in the metal shop (CR: 4D).
 4. Gives examples of industry-specific tooling (equipment) used in metal manufacturing processes (CR: 1E, 3C, 3D).

STRAND VI: METAL PROCESSING MACHINES

CONTENT STANDARD: *The student understands the proper use and application of a variety of metal processing machines.*

- F. The student exhibits proper use and maintenance of metal processing machines (e.g., machine tools, welding machines, sheet metal equipment, and foundry equipment).
 1. Understands electrical specifications (CSS 9) and exhibits proper safety and operations on an advanced machine tool (WK, CR: 4D).

2. Develops skills in metal machining processes, which includes measuring, lathe work, mill work, grinding, and shaping (CR: 1E, 3C, 3D).
3. Performs basic setup of all machines and equipment used in the metal shop (CR: 1E, 3C, 3D).
4. Incorporates machine combinations in all projects (WK).
5. Uses appropriate technologies (CSS 2) to synthesize, organize (CLAS 7), and accurately interpret information (CLAS 5) presented in a technical format (CLAS 6) from textbooks and other resources to provide background information on each piece of equipment (WK, CR: 3A).
5. Investigates other related technological machines not found in the classroom (CR: 3A).
6. Accurately interprets information (CLAS 5) and applies working knowledge and procedures in foundry operations, sheet metal operations, welding techniques, and metal fabrication techniques from a variety of informational and technical texts (CLAS 5) (CR: 1E).

STRAND VII: ASSEMBLY

CONTENT STANDARD: *The student demonstrates understanding of assembly processes.*

G. The student identifies and applies proper assembling techniques.

1. Uses appropriate technologies and measurement techniques (CSS 2, 4).
2. Uses the vertical position to assemble plates in the welding processes (WK, CR: 1D).
3. Understands the physical and chemical properties of metals (CSS 7) and develops skills in metal cutting, plasma arc, shielded metal arc welding, MIC and TIG welding, oxyacetylene systems for cutting and welding, copper sweating, and spot welding (CR: 1E, 3C, 3D).

STRAND VIII: CAREER PATHWAYS AND EMPLOYMENT SKILLS

CONTENT STANDARD: *The student explores career pathways and has access to post-secondary institutions. (CLAS 1—10).*

H. The student recognizes and takes advantage of career opportunities in post-secondary institutions.

1. Develops awareness of opportunities in post-secondary institutions (CR: 3A).
2. Demonstrates employability skills (CR: 2A, 2B, 4A, 5C, 5E).
3. Collaborates and cooperates with others
 - a. Completes assigned tasks in a timely manner
 - b. Practices positive behavior in all settings
 - c. Follows directions
 - d. Communicates effectively in both oral and written form
 - e. Problem solves and thinks critically
4. Examines levels of education and training needed for career positions consistent with interest, aptitude, and skills (CR: 1A).
5. Develops awareness of advances in metal-working equipment and the importance of the industry in society (CR: 1B, 3C, 3D, 4E).
6. Evaluates the influence of technology on society (CSS 11).

Metals II: Assessment Illustrations

Note: These assessment illustrations include suggested activities for attaining each performance standard, with at least one key feature to look for while assessing student performance. A check (✓) refers to a key feature to look for while assessing student performance.

STRAND I: SAFETY

CONTENT STANDARD: *The student exhibits the safe use of equipment and shop practices.*

1. The student continues to demonstrate proficiency on each machine by passing a general safety test with 100% accuracy. Areas to be tested are safety glass, welding, machine foundry, and sheet metal. The student reviews the safety data sheets for each machine and takes a safety test relevant to each machine. After a teacher demonstration, the student demonstrates proficiency on each machine under teacher supervision. Test results are kept on file for liability purposes.
- 2-4, 6,7. The student demonstrates safe and proper material handling during the construction of an advanced project that meets with instructor approval.
 - ✓ safety practices
 - ✓ correct use of tools
 - ✓ appropriate behavior
5. The student reviews locations of all fire extinguishers and their uses, as well as all exits.
 - ✓ correct identification of locations and exits

STRAND II: MATERIAL IDENTIFICATION AND APPLICATION

CONTENT STANDARD: *The student identifies metals and describes their applications.*

1. The student does simple heat treating of steel: a) takes a hard piece of steel and softens it using the annealing process b) hardens the surface of soft steel with the case hardening process c) discerns the temperature of steel through colors.
 - ✓ test – cut with a file
 - ✓ Rockwell hardness test
- 2-3. The student selects an advanced project (with instructor approval) and completes an assigned activity utilizing the appropriate materials.
 - ✓ completion of project
 - ✓ quality of project
 - ✓ safety practices
 - ✓ correct metals usage
 - ✓ technological applications

STRAND III: MEASUREMENT

CONTENT STANDARD: *The student demonstrates the use of measuring instruments to find tolerances.*

1. Given a material of stock, the student measures within .005 or .01 mm.
 - ✓ accuracy
- 2-3. After practice on a variety of machines and tools, the student builds a machine tool project (e.g., bolt) that meets with criteria established by the instructor (e.g., size). Upon completion, the student presents his project to the class discussing the process used, problems he may or may not have had in its construction, and how they were resolved.
 - ✓ accuracy
 - ✓ quality of final product
 - ✓ correct use of tools and machines
- 4-7. The student builds an advanced project (e.g., welding fabrication of a trailer, table) following the specifications of a blueprint.
 - ✓ accurate scale measures
 - ✓ accurate measuring
 - ✓ mathematical applications
 - ✓ use of symbols

STRAND IV: DESIGN/PLAN/LAYOUT

CONTENT STANDARD: *The student interprets and implements proper procedures and problem-solving techniques.*

1. The student puts a metal bar into the lathe and fabricates a shoulder, diameter length within .015.
 - ✓ correct measurements
 - ✓ acceptable tolerances
- 2-6. The student produces a concept drawing to include materials needed, proper dimensions, procedures to be utilized, bill of materials, cut list, tools that will be used, and cost of materials. With instructor approval, the student builds the project.
 - ✓ all required components
 - ✓ legibility
 - ✓ order
 - ✓ workmanship
 - ✓ appropriateness
 - ✓ problem-solving strategies

Activity: The student writes a CNC program using G-CODES and the Cartesian coordinate system to machine a unique design or pattern of student choice on a two-inch aluminum block.

STRAND V: HAND TOOLS/POWER TOOLS

CONTENT STANDARD: *The student demonstrates an advanced understanding of the proper use and application of hand/hand-held, and power tools.*

- 1-4. The student incorporates a variety of tools (e.g., drill motor) to successfully complete an advanced project as approved by the instructor.

Included in the project is a demonstration of skills and techniques (e.g., using a combination set to check squareness of stock, drilling a 1/2 inch hole).

- ✓ proficiency
- ✓ appropriate level of difficulty for the project
- ✓ safety procedures
- ✓ selection of tools
- ✓ quality of project

Activity: Student develops a plan of procedure that lists all tools and equipment in proper order to complete a project.

STRAND VI: METAL PROCESSING MACHINES

CONTENT STANDARD: *The student understands the proper use and application of a variety of metal processing machines.*

1. The student reviews the safety data sheets and takes a test on the machine group demonstrated by the instructor. This practice is repeated for each machine group the student is required to learn.
 - ✓ comprehension
 - ✓ accuracy (100%)
- 2-4,7. The student selects a project that meets with the instructor's approval and constructs it following set up procedures, tool usage, efficiency of materials, and practicing advanced techniques. Upon completion, the student presents his project, either formally or informally, and discusses any difficulties encountered and how they were resolved.
 - ✓ required components and procedures
 - ✓ increased skills
- 5-6. Because of time or equipment availability, the student many times has to research or study further the project on which he is preparing to work. Textbook study, videos, and Internet searches advance the student's knowledge and enhances the quality of the final product. The student imparts understanding through oral or written summaries or through conferencing with the instructor.
 - ✓ understanding of new information
 - ✓ effective communication

STRAND VII: ASSEMBLY

CONTENT STANDARD: *The student demonstrates understanding of assembly procedures.*

1. The student fits up and welds the following in a vertical position: butt weld, lap weld, tee weld, and edge weld.
 - ✓ appropriate welding techniques
 - ✓ correct positioning
2. The student completes lab exercises or projects in each of the following areas: proper use of equipment, cleaning of functional welds, cuts, and brazings.
 - ✓ skill development
 - ✓ safety practices
 - ✓ appropriate techniques

STRAND VIII: CAREER PATHWAYS AND EMPLOYMENT SKILLS

CONTENT STANDARD: *The student explores career pathways and has access to post-secondary education.*

- 1-3. The student tours post-secondary institutions (e.g., TVI, UNM), businesses (e.g., Intel), or governmental agencies (e.g., Sandia Labs) to learn about opportunities for careers in the welding field. Upon return, the student participates in a class discussion sharing what was observed and learned or writes a personal reflection on what was observed and learned and what further preparation the student must undertake to succeed in the field.
 - ✓ pertinent information (e.g., education, training)
 - ✓ effective communication
 - ✓ appropriate behavior
4. The student listens attentively to guest speakers brought in from the community or trade schools to talk about related careers, technological advances in the field, and societal needs met by these positions. The student prepares in advance relevant questions to ask the speakers and writes a summary of the presentation afterwards.
 - ✓ clarity
 - ✓ comprehension
 - ✓ relevance
 - ✓ positive behavior
5. The student addresses all environmental concerns (e.g., cycling, waste elimination) within his control on all projects performed in class by employing appropriate safety practices.

Production Technology—Directed Design Projects: Pathway Standards

Production Technology — Directed Studies provides a student with individual study in an area of advanced metal working. The student assumes responsibility for identifying, pursuing, and culminating an activity that expands knowledge about some phase of industry. An individual plan is required to be approved by the instructor, parent, guardian, student, and school administrator. The course may be a TVI articulated/concurrent enrollment course.

References in parenthesis following some of the descriptors refer to performance standards found in the NM Career Readiness Standards (CR), the Professional Development Plan (PDP), and critical mathematics (CMS) , science (CSS), and language arts (CLAS) content standards.

STRAND I: DIRECTED DESIGN PROJECTS

CONTENT STANDARD: *The student pursues advanced individual study in an area of metal working.*

- A. The student identifies, organizes, and completes a course of study in an area of specialized interest in the metals industry.
 - 1. Utilizes informational texts, evaluates information, and uses multiple resources to identify and define a technological problem related to a career interest (CLAS 1, 2, 3, 5, 6, 7) (CR:3D).
 - 2. Utilizes appropriate scientific methods to design and conduct an investigation of a technological problem related to a career interest (CSS 1).
 - 3. Uses resources and technologies (CSS 2) to seeks new knowledge, synthesizes information to solve the defined problem (CLAS 4) (CR: 5).
 - 4. Creates models to describe phenomena (CSS 3).
 - 5. Reads critically and independently to draw conclusions from research (CLAS 8).
 - 6. Uses a variety of technology tools (CLAS 9) to develop a timeline and schedule, including relevant information and resources (CLAS 7) (CR: 2A).
 - 7. Identifies computational methods, mathematical strategies, and measurement techniques (CSS 4) necessary to complete the project (CMS 3, 6).
 - 8. Manages activities necessary to complete project (CR: 2A, 5A).
 - 9. Creates multiple displays of data to analyze and explain relationships in the technological problem (CSS 10).
 - 10. Evaluates and interprets (CLAS 5,6) the solutions that have been completed (CR: 5E, 5F).
 - 11. Demonstrates the ability to transfer technical and academic skills from the classroom to careers (CR: 1E).

STRAND II: CAREER PATHS

CONTENT STANDARD: *The student develops an advanced knowledge of various technical fields that are related to metal working .*

- B. The student participates in activities to investigate career fields and researches requirements for metals career.
 - 1. Investigates through the use of technologies the skills requirements for metal working career (CR: 2B, 3A, 3B, 3C, 3D).
 - 2. Compares educational requirements need for different levels of employment in metal working careers (CR: 1B, 3C0).
 - 3. Examines career choices through course applications (CR: 1A, 3D).

STRAND III: EMPLOYMENT SKILLS

CONTENT STANDARD: *The student models positive employability skills/good work ethic.*

- C. The student develops leadership skills within the work setting at school.
 - 1. Collaborates and cooperates with other students using effective leadership, interpersonal, problem-solving, critical thinking, and team skills (PDP Level 4.8, 4.11; CR: 2B, 5A 5C, 5D, 5E).
 - 2. Understands how to use data from surveys, samplings, estimations, and inferences to address specific problems (CLAS 3).
 - 3. Uses multiple resources to gather information and accurately interpret information presented in a technical format (CLAS 3, 6, 7).
 - 4. Demonstrates respect for equipment, software, etiquette, and observes all ethical guidelines for industry (PDP Level 4.8, 5.6; CR: 3A, 3B, 3C, 3D).
 - 3. Demonstrates respect for one another and self (PDP Level 4.8, 4.11; CR: 4A, 4B, 4C, 4E).
 - 4. Conforms to established rules and regulations ((PDP Level 4.8, 4.11; CR: 4C, 4D).
 - 5. Maintains appropriate appearance and punctuality (PDP Level 4.11; CR: 4A).
 - 6. Completes assigned tasks in a timely manner (PDP Level 4.8, 4.11, 5.6; CR: 4B, 4C).
 - 7. Analyzes and integrates positive behavior, conduct, and social manners within the school and work place (PDP Level 4.8, 4.11; CR: 4A).
 - 8. Communicates effectively in both oral and written forms (e.g., understanding informational text; evaluate problems; accessing and sending electronic information; presenting information appropriate for the purpose and audience; make well-informed and well-organized formal presentations with a clear main point, adjusting the message, wording and delivery to the particular audience and context) (CLAS 1, 3, 4, 9, 10) (PDP Level 4.8, 4.11, 5.6).
 - 9. Follows directions (PDP Level 4.8, 4.11, 5.6).

Production Technology: Assessment Illustrations

Note: These assessment illustrations include suggested activities for attaining each performance standard, with at least one key feature to look for while assessing student performance. A check (✓) refers to a key feature to look for while assessing student performance.

STRAND I: DIRECTED DESIGN PROJECTS

CONTENT STANDARD: The student pursues advanced individual study in an area of metal working/woodworking.

1-6. The student chooses a product to manufacture and explores commercial applications. The student researches other products, begins drawings, and maintains a notebook of researched materials and supplies needed for such a project. With an agreed upon timeline, the student works individually and maintains contact with the instructor to develop a complete project.

- ✓ adherence to timelines
- ✓ completion of required activities
- ✓ scrutinization of materials and supplies
- ✓ comprehension
- ✓ application of skills and knowledge
- ✓ problem solving

Activity: The student using Plasma CAM software creates a shape, sign, or design for a steel plate and burns it out with a plasma torch.

STRAND II: CAREER PATHS

CONTENT STANDARD: The student develops an advanced knowledge of various technical fields that are related to metal working.

1-3. The student gathers information about careers by visiting industry and technical schools, checking reference materials [e.g., Occupational Outlook Handbook (OOH), Occupational Information Network software (O*NET), magazines, pamphlets]. The student needs to research types of careers available, tasks involved in particular jobs, education, special skills, and/or training required, salary and benefits.

- ✓ use of technology
- ✓ completion of task
- ✓ relevancy, OR

The student makes contact with a variety of people (e.g., people employed in the field of interest, other teachers and counselors at the school, professional associations) and interviews them to find out training, educational requirements, and opportunities available in the field.

- ✓ use of technology
- ✓ completion of task
- ✓ relevancy

Extension: The student may want to explore getting a part-time job in the field or doing volunteer work in the field.

- ✓ supervisor's evaluation

STRAND III: EMPLOYABILITY SKILLS

CONTENT STANDARD: *The student models positive employability skills/good work characteristics.*

1-4, 6-9. The student investigates on-line entrepreneurship opportunities as a team member and reports findings to the team.

- ✓ collaboration and cooperation
- ✓ ethical considerations
- ✓ use of technology
- ✓ appropriate behavior
- ✓ completion of all task components
- ✓ effective communication
- ✓ adherence to criteria and guidelines

1, 3-9. The student manages a project and evaluates others.

- ✓ leadership skills
- ✓ problem solving and critical thinking
- ✓ assessments
- ✓ cooperation and collaboration
- ✓ respect for others
- ✓ effective communication

2, 8, 9. The student refines his/her employment portfolio.

- ✓ ethical considerations
- ✓ required components
- ✓ organization
- ✓ quality of portfolio
- ✓ effective communication