2005 Mississippi Curriculum Framework

Secondary Metal Trades

(Program CIP: 48.0590 – Metal Trades)

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Academic Standards Mississippi Department of Education Subject Area Testing Program

Workplace Skills for the 21st Century Secretary's Commission on Achieving Necessary Skills

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Foreword

Secondary vocational-technical education programs in Mississippi are faced with many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, ch. 487, §14; Laws, 1991, ch. 423, §1; Laws, 1992, ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act III, 1998; and No Child Left Behind Act of 2001).

Each secondary vocational-technical course consists of a series of instructional units which focus on a common theme. All units have been written using a common format which includes the following components:

- Unit Number and Title
- Suggested Time on Task - An estimated number of clock hours of instruction that should be required to teach the competencies and objectives of the unit. A minimum of 140 hours of instruction is required for each Carnegie unit credit. The curriculum framework should account for approximately 75-80 percent of the time in the course.
- Competencies and Suggested Objectives
  - A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies.
  - The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.
- Suggested Teaching Strategies - This section of each unit indicates strategies that can be used to enable students to master each competency. Emphasis has been placed on strategies which reflect active learning methodologies. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.
- Suggested Assessment Strategies - This section indicates strategies that can be used to measure student mastery. Examples of suggested strategies could include rubrics, class participation, reflection, and journaling. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources.

- Integrated Academic Topics, Workplace Skills, Technology Standards, and Occupational Standards - This section identifies related academic topics as required in the Subject Area Assessment Program (SATP) in Algebra I, Biology I, English II, and U. S. History from 1877, which are integrated into the content of the unit. It also identifies the general workplace skills as identified in the Secretary's Commission on Achieving Necessary Skills (SCANS) report as being critical for all workers in the 21st Century. In addition, national technology standards and occupational skills standards associated with the competencies and suggested objectives for the unit are also identified.
- References - A list of suggested references is provided for each unit. The list includes some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested and the list may be modified or enhanced based on needs and abilities of students and on available resources.

Table of Contents

Program Description

The Metal Trades program is designed as a cluster program for preparation to enter the metal working trades. Metal Trades I includes an introduction to the basic metal working processes. Metal Trades II requires that students choose one of two options (Advanced Welding Option or Advanced Machine Shop Option). The purpose of the course is to prepare students to continue study in a postsecondary metal trades program (Welding, Machine Tool Operation, or Sheet Metal) or to begin work at the entry level in a metal trades occupation.

This curriculum has been aligned to modules in the Wheels of Learning program as endorsed by the National Center for Construction Education and Research (NCCER). Students who study this curriculum using the Wheels of Learning materials under the supervision of an instructor who has been certified by the NCCER are eligible to be tested on each module. Students who successfully pass these tests may be certified to the NCCER by the instructor and will receive documentation from NCCER.

Metal Trades curriculum framework is aligned to the NCCER Core and Millwright Level I.

Course Outline

Metal Trades I

Course CIP Code: 48.0590

Unit	Title	Hours
Unit 1:	Orientation and Leadership	10.0
Unit 2:	Basic Safety	15.0
Unit 3:	Basic Math	12.0
Unit 4:	Introduction to Blueprints	8.0
Unit 5:	Hand and Power Tools	10.0
Unit 6:	Basic Rigging	8.0
Unit 7:	Millwright	58.0
Unit 8:	Power Saws and Drilling Machines	24.0
Unit 9:	Basic Welding	25.0
Unit 10:	Basic Machine Shop	25.0
Unit 11:	Introduction to Sheet Metal	10.0

Metal Trades II (Advanced Welding Option)

Course CIP Code: 48.0592

Unit	Title	Hours
Unit A1:	Orientation, Advanced Leadership, and Employability Skills	10.0
Unit A2:	Basic Safety	8.0
Unit A3:	Shielded Metal Arc Welding (SMAW)	112.0
Unit A4:	Gas Metal Arc Welding (GMAW) & Flux Core Arc Welding (FCAW)	30.0
Unit A5:	Introduction to Gas Tungsten Arc Welding (GTAW)	31.0
Unit A6:	Plasma Arc Cutting (PAC)	8.0

Metal Trades II (Advanced Machine Shop Option)

Course CIP Code: 48.0592

Unit	Title	Hours
Unit B1:	Orientation, Advanced Leadership, and Employability Skills	10.0
Unit B2:	Basic Safety	8.0
Unit B3:	Lathe Operations	105.0
Unit B4:	Milling Operations	52.0
Unit B5:	Grinding Operations	23.0

Metal Trades I
Unit 1: Orientation and Leadership (10 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe local program and vocational/career technical center policies and procedures. a. Describe local program and vocational/career technical center policies and procedures including dress code, attendance, academic requirements, discipline, and transportation regulations.	**Teaching:** • Present local program and vocational/career technical center policies and procedures.[E2] • Students will read the handbook to become aware of what is expected of them in relation to the policies and procedures of the school. This will include dress code, attendance, academic requirements, discipline, and transportation regulations. Students will work together in pairs. A student with a higher reading ability will team up with a student with a lower reading ability to get a better understanding of the school's program policies and procedures. Submit written report on rules and regulations. [E2, E3, E8] **Assessment:** • Assess student knowledge of orientation, policies, and procedures through instructor observations and written unit test. File completed test to document student mastery of the school and program policies and procedures. • The report will be evaluated for clarity and content.
2. Describe employment opportunities and responsibilities. a. Describe employment opportunities including potential earnings, employee benefits, job availability, place of employment, working conditions, and educational requirements. b. Describe basic employee responsibilities.	**Teaching:** • Define trade terms related to basic employability skills. • Students will interview individuals in the metal trades industry. Students will be provided questions by the instructor. The student will write a report on the interview and present the report to the class.[E1, E2] • Students will research the phone book, Internet, and newspapers for employment opportunities.[E3, E8] • Students will participate in a mock interview. Industry representatives will interview students. • Invite a guest speaker to speak on industry

	related information. • Students will use career software to measure their aptitudes and abilities for particular careers.[E3, E8] • Students will use available resources (college catalogs and websites) to research information about postsecondary educational opportunities.[E2, E3, E4, E5, E10] • Students will select a career in the field and outline educational and skill requirements, expected job growth, and entry-level salaries.[E1, E3, E8, E9] **Assessment:** • Assessment will be determined by matching test for definitions. Lessons involving writing and math skills will be integrated with the appropriate department. • A checklist will be used to evaluate each student. • The presentation and report on the metal trades industry interview will be evaluated using a rubric. • Use a checklist to evaluate the presentation. • Review career software printout to assess student aptitudes and abilities.
3. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA. a. Demonstrate effective teambuilding and leadership skills. b. Practice appropriate work ethics.	**Teaching:** • Discuss the role of a team member and leader. Assign the students roles within a team and have them role play a situation in which there is a conflict which must be resolved. Utilize the lessons from SkillsUSA or other resources to provide additional training.[E3, E8] • Discuss appropriate work ethics standards. Have the students list what they believe to be the most common problems within the metal trades profession. **Assessment:** • Assess the role play using a checklist for documentation. • Lessons from other resources should be assessed according to the recommended resource guide. • The list of work ethic practices will be

	graded for clarity and content.
4. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations.	**Teaching:** • Have the students perform an activity involving verbal instructions. Divide the students into groups and have one team be the customer and the other be the service advisor. The customer will describe the concerns, and the service advisor will provide an explanation of the processes that will need to be followed for them to properly diagnose the concerns. Have the groups switch roles and repeat the process. E2, E3, E4, E8 • The student will be given a work order. The work order will contain written instructions of a specific job. The student will complete the work order. **Assessment:** • The lesson will be assessed using a rubric. • The work order will be evaluated using a checklist.
5. Discuss the history of metal trades industry to include materials, terminology, and techniques.	**Teaching:** • Discuss the history of the metal trades industry. Have the students research the history of the metal trades industry and develop a presentation for the class. H1, H2 **Assessment:** • Assess the presentation using a checklist.

STANDARDS

Contren Learning Series Best Practices

SAF1 Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2 Explain the role that safety plays in the construction crafts.
SAF3 Describe what job-site safety means.
SAF4 Explain the appropriate safety precautions around common job-site hazards.
SAF5 Demonstrate the use and care of appropriate personal protective equipment.
SAF5 Follow safe procedures for lifting heavy objects.
SAF6 Describe safe behavior on and around ladders and scaffolds.
SAF7 Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8 Describe fire prevention and fire fighting techniques.
SAF9 Define safe work procedures around electrical hazards.

MAT1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2 Use a standard ruler and a metric ruler to measure.
MAT3 Add, subtract, multiply, and divide fractions.
MAT4 Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5 Convert decimals to percents and percents to decimals.
MAT6 Convert fractions to decimals and decimals to fractions.
MAT7 Explain what the metric system is and how it is important in the construction trade.
MAT8 Recognize and use metric units of length, weight, volume, and temperature.
MAT9 Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1 Recognize and identify some of the basic hand tools used in the construction trade.
HTO2 Use these tools safely.
HTO3 Describe the basic procedures for taking care of these tools.
PTO1 Identify commonly used power tools of the construction trade.
PTO2 Use power tools safely.
PTO3 Explain how to maintain power tools properly.
BLU1 Recognize and identify basic blueprint terms, components, and symbols.
BLU2 Relate information on blueprints to actual locations on the print.
BLU3 Recognize different classifications of drawings.
BLU4 Interpret and use drawing dimensions.
RIG1 Identify and describe the use of slings and common rigging hardware.
RIG2 Describe the basic inspection techniques and rejection criteria used for slings and hardware.
RIG3 Describe the basic hitch configurations and their proper connections.
RIG4 Describe basic load-handling safety practices.
RIG5 Demonstrate proper use of American National Standards Institute (ANSI) hand signals.
COM1 Demonstrate the ability to understand information and instructions that are presented in both written and verbal form.
COM2 Demonstrate the ability to communicate effectively in on-the-job situations using written and verbal skills.
EMP1 Explain the construction industry, the role of the companies that make up the industry, and the role of individual professionals in the industry.
EMP2 Demonstrate critical thinking skills and the ability to solve problems using those skills.
EMP3 Demonstrate knowledge of computer systems and explain common uses for computers in the construction industry.
EMP4 Demonstrate effective relationship skills with teammates and supervisors, exhibit the ability to work on a team, and demonstrate appropriate leadership skills.
EMP5 Be aware of workplace issues such as sexual harassment, stress, and substance abuse.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

FASTENERS

MFF1 Identify and explain threaded fasteners.
MFF2 Identify and explain nonthreaded fasteners.
MFF3 Identify and explain insulation fasteners.
MFF4 Install fasteners.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

CUTTING AND FITTING GASKETS

MCF1 Identify and explain gasket types.
MCF2 Identify and explain gasket materials.
MCF3 Lay out and cut gaskets.
MCF4 Install gaskets.

OXY-FUEL CUTTING

MOC1 Explain Oxy-fuel cutting safety.
MOC2 Identify and explain Oxy-fuel cutting equipment.
MOC3 Identify and explain Oxy-fuel flames.
MOC4 Identify and explain backfire and flashbacks.
MOC5 Set up oxy-fuel equipment.
MOC6 Light and adjust an oxy-fuel torch.
MOC7 Shut down oxy-fuel cutting equipment.
MOC8 Disassemble oxy-fuel equipment.
MOC9 Change empty cylinders.
MOC10 Perform housekeeping tasks.
MOC11 Perform oxy-fuel cutting:
- Straight-line and square shapes

- Piercing and slot cutting
- Bevels
- Washing
- Gouging

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T2 Social, ethical, and human issues
T3 Technology productivity tools
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Check, A., Krar, S., & Rapisarda, M. (1998). *Machine tool and manufacturing technology.* Albany, NY: Delmar.

Jeffus, L. (1999). *Welding principles and applications.* Albany, NY: Delmar.

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Taylor, D. (1996). *Elementary blueprint reading for machinists* (4th ed.). Albany, NY: Delmar.

Walker, J. (2000). *Modern metalworking.* Tinley Park, IL: Goodheart-Willcox.

Metal Trades I
Unit 2: Basic Safety **(15 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe general safety rules for working in a shop/lab and industry. a. Describe how to avoid on-site accidents. b. Explain the relationship between housekeeping and safety. c. Explain the importance of following all safety rules and company safety policies. d. Explain the importance of reporting all on-the-job injuries and accidents. e. Explain the need for evacuation policies and the importance of following them. f. Explain the employer's substances abuse policy and how it relates to safety. g. Explain the safety procedures when working near pressurized or high temperature.	**Teaching:** **This can be used for the entire unit.** • Identify, discuss, and demonstrate terms, rules, and procedures related to shop/lab and industry safety. E3, E8 • Required written tests will follow each section of guidelines for safety rules and procedures. • Provide the students with a list of terms and have them define the terms. Pair the students to quiz each other on the definitions in preparation for a written exam. E2, E3, E4, E8 • Use the guidelines provided for personal safety (i.e., clothing, jewelry, hair, eyes, and ears). Divide the students into pairs and assign each pair one of the guidelines. Each pair will demonstrate the "do's and don'ts" of the assigned guideline. • Have an industry speaker present to the class the necessity of safety in the work environment. The students will write a summary of the presentation. E1, E2, E9 • Divide the students into teams and have them develop scenarios of hazards and accidents using trade publications and the Internet. This will include tools, spills, working around welding, ladders or scaffolds, use of MSDS information, fires, and electrical situations. In a game type situation, one team will read a scenario and the other teams will compete to be the first to provide the proper safety measures which should have been used to prevent the hazardous situation. Points will be awarded to the teams with the correct answers. E2, E4 • Required written tests will follow each section of guidelines for safety rules and procedures. • NOTE: SAFETY IS TO BE TAUGHT AS AN ONGOING PART OF THE COURSE THROUGHOUT THE YEAR.
2. Identify and apply safety around metal trades operations. a. Use proper safety practices when performing metal trades operations. b. Recognize and explain personal protective equipment. c. Inspect and care for personal protective equipment.	
3. Explain lifting. a. Identify and explain the procedures for lifting heavy objects.	
4. Explain the Material Safety Data Sheet (MSDS). a. Explain the function of the MSDS. b. Interpret the requirements of the MSDS.	
5. Explain fires. a. Explain the process by which fires start. b. Explain fire prevention of various flammable liquids.	

c. Explain the classes of fire and the types of extinguishers. 6. Explain safety in and around metal trades and electrical situations. a. Explain injuries when electrical contact occurs. b. Explain safety around metal trades and electrical hazards. c. Explain action to take when an electrical shock occurs.	**Assessment:** • Student participation will be monitored by the instructor and the written exam will be graded. The student must achieve 100% accuracy. • The "do's and don'ts" exercise will be critiqued with a peer review. • The summary of the speaker's presentation will be critiqued using a rubric. • The teams will be rewarded according the points earned from the game. This could be extra points, classroom privileges, etc. • Written exams will be graded.

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E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
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E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T2 Social, ethical, and human issues
T3 Technology productivity tools
T4 Technology communications tools
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Metal Trades I
Unit 3: Basic Math **(12 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Apply the four basic math skills with whole numbers, fractions, and percent. a. Add, subtract, multiple, and divide whole numbers, decimals, and fractions. b. Convert whole numbers to fractions, and convert fractions to whole numbers. c. Convert decimals to percent and percent to decimals. d. Convert fractions to decimals. e. Convert fractions to percent.	**Teaching:** • Have students complete a short pretest to apply the four basic math skills with whole numbers, fractions, and percent.[A1] • Give students the correct answers to problems, and ask at least one student who got the answers for whole numbers correct to write the problems on the chalkboard or a piece of chart paper. Have students who did not get the problems correct listen as the student at the board/paper works the problems. Do this procedure for fractions and percent as well, having students rotate through the skills until each student has spent time with each set of problems. Have a different student lead the discussion each time students rotate so that the students who are just learning how to work the problems have a chance to teach the other students.[E2, E4, E5] • Provide students with additional problems to apply the four basic math skills with whole numbers, fractions, and percent while working in small groups and then alone. **Assessment:** • Monitor group work as students perform calculations using a rubric. • The pretest score will be compared to the posttest score.
2. Use the metric system. a. Use a standard and metric ruler to measure. b. Explain what the metric system is and its importance. c. Recognize and use metric units of length, weight, volume, and temperature.	**Teaching:** • Discuss the metric system and its importance. • Divide students into groups and have them design a small building project appropriate for the program, including dimensions in standard and metric measurements.[A1] • Have students use stiff paper (or materials in the shop) to build a simple model, measuring the pieces using both standard and metric rulers to ensure that the model

	is to proper scale with the design.[A2] • Distribute a variety of metric measuring tools for length, weight, volume, and temperature. Have students measure assigned materials using the appropriate tools and record the measurements.[A2] • Have each student write or type (if technology resources are available) a paper comparing the use of the standard and metric systems and proposing why the United States should or should not use the metric system.[E1, E9, E10] **Assessment:** • Compare design specifications to the constructed model to ensure that measurements are correct. A rubric will be used for evaluation. • Evaluate each student's measurements for accuracy. • Evaluate each student's paper for content as well as grammar and organization using a rubric. • Evaluate each student's measurements for accuracy. • Evaluate each student's paper for content as well as grammar and organization.
3. Apply basic mathematics for welding. a. Calculate area and volume of simple geometric figures. b. Apply basic math to solve simple geometric figures and problems.	**Teaching:** • Discuss and demonstrate the basic mathematic applications in welding.[A1, A3, A5] • Have students apply the applications in solving real work related problems using the Contren Welding Level 1 Unit or other materials.[A1, A3, A5] **Assessment:** • Assessment of the problems will be Contren examinations and performance examinations.

STANDARDS

Contren Learning Series Best Practices

MAT1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.

Secondary Metal Trades

MAT2 Use a standard ruler and a metric ruler to measure.
MAT3 Add, subtract, multiply, and divide fractions.
MAT4 Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5 Convert decimals to percents and percents to decimals.
MAT6 Convert fractions to decimals and decimals to fractions.
MAT7 Explain what the metric system is and how it is important in the construction trade.
MAT8 Recognize and use metric units of length, weight, volume, and temperature.
MAT9 Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
BLU1 Recognize and identify basic blueprint terms, components, and symbols.
BLU2 Relate information on blueprints to actual locations on the print.
BLU3 Recognize different classifications of drawings.
BLU4 Interpret and use drawing dimensions.

FASTENERS

MFF1 Identify and explain threaded fasteners.
MFF2 Identify and explain nonthreaded fasteners.
MFF3 Identify and explain insulation fasteners.
MFF4 Install fasteners.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

CUTTING AND FITTING GASKETS

MCF1 Identify and explain gasket types.
MCF2 Identify and explain gasket materials.
MCF3 Lay out and cut gaskets.
MCF4 Install gaskets.

OXY-FUEL CUTTING

MOC1 Explain oxy-fuel cutting safety.
MOC2 Identify and explain oxy-fuel cutting equipment.
MOC3 Identify and explain oxy-fuel flames.
MOC4 Identify and explain backfire and flashbacks.
MOC5 Set up oxy-fuel equipment.
MOC6 Light and adjust an oxy-fuel torch.
MOC7 Shut down oxy-fuel cutting equipment.
MOC8 Disassemble oxy-fuel equipment.
MOC9 Change empty cylinders.
MOC10 Perform housekeeping tasks.
MOC11 Perform oxy-fuel cutting:
- Straight-line and square shapes
- Piercing and slot cutting
- Bevels
- Washing
- Gouging

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.
A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
A5 Utilize various formulas in problem-solving situations.
E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T2 Social, ethical, and human issues
T3 Technology productivity tools
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Check, A., Krar, S., & Rapisarda, M. (1998). *Machine tool and manufacturing technology.* Albany, NY: Delmar.

Jeffus, L. (1999). *Welding principles and applications.* Albany, NY: Delmar.

National Center for Construction Education and Research. (1992). *Millwright level I.* Upper Saddle River, NJ: Pearson Prentice Hall.

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National Center for Construction Education and Research. (2004). *Core curriculum.* Upper Saddle River, NJ: Pearson Prentice Hall.

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Walker, J. (2000). *Modern metalworking.* Tinley Park, IL: Goodheart-Willcox.

Metal Trades I
Unit 4: Introduction to Blueprints (8 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Read, analyze, and design a blueprint. a. Identify terms and symbols commonly used on blueprints. b. Relate information on prints to real parts/models. c. Interpret various symbols to locate various elements. d. Interpret a plan to determine layout. e. Explain basic layout of a blueprint. f. Describe the information in a title block. g. Identify the lines used on blueprints. h. Explain an engineer's scale.	**Teaching:** • Using a computerized representation of a blueprint (may use AutoCAD if available) or an overhead, explain all terms, symbols, and abbreviations on the blueprint and how they are used to locate various elements. • Divide students into pairs and have them quiz each other on the terms and symbols. • Have each student interpret a plan and match it to an actual picture of the area; and interpret the information to the class. E2, E4, E9 • Have students work as a team to prepare a blueprint of a metal trades model to present to a client. • Have students type a letter/report to the client and prepare blueprints including symbols and drawings, title block, lines, and scales for the client. E1, E5, E9 **Assessment:** • Monitor group work as students quiz each other, and use a checksheet of symbols to monitor student success. • Determine if each student matches the plan to the correct picture, and evaluate his or her interpretation of the information to the class for accuracy, clarity, and presentation skills. • Review the blueprint for accuracy, and grade the letter/report for accuracy of content, grammar, and organization using a rubric. • Evaluate the project according to a checklist or rubric.

STANDARDS

Contren Learning Series Best Practices

MAT1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2 Use a standard ruler and a metric ruler to measure.

MAT3 Add, subtract, multiply, and divide fractions.
MAT4 Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5 Convert decimals to percents and percents to decimals.
MAT6 Convert fractions to decimals and decimals to fractions.
MAT7 Explain what the metric system is and how it is important in the construction trade.
MAT8 Recognize and use metric units of length, weight, volume, and temperature.
MAT9 Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
BLU1 Recognize and identify basic blueprint terms, components, and symbols.
BLU2 Relate information on blueprints to actual locations on the print.
BLU3 Recognize different classifications of drawings.
BLU4 Interpret and use drawing dimensions.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

CUTTING AND FITTING GASKETS

MCF1 Identify and explain gasket types.
MCF2 Identify and explain gasket materials.
MCF3 Lay out and cut gaskets.
MCF4 Install gaskets.

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.

E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T3 Technology productivity tools
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Check, A., Krar, S., & Rapisarda, M. (1998). *Machine tool and manufacturing technology.* Albany, NY: Delmar.

Jeffus, L. (1999). *Welding principles and applications.* Albany, NY: Delmar.

National Center for Construction Education and Research. (1992). *Millwright level I.* Upper Saddle River, NJ: Pearson Prentice Hall.

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Taylor, D. (1996). *Elementary blueprint reading for machinists* (4th ed.). Albany, NY: Delmar.

Walker, J. (2000). *Modern metalworking.* Tinley Park, IL: Goodheart-Willcox.

Metal Trades I
Unit 5: Hand and Power Tools **(10 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Demonstrate the use and maintenance of various hand and power tools. a. Identify and discuss the use of common hand and power tools. b. Discuss rules of safety. c. Select and demonstrate the use of tools. d. Explain the procedures for maintenance.	**Teaching:** • Identify basic hand and power tools (e.g., hammer, screwdriver, saw, wrench, pliers, and drill) used in the field (NCCER) and how they have advanced through time.[H2] • Discuss safety factors, proper use, and maintenance. • Describe accidents that can occur while using tools. • Divide students into groups and give each group a scenario/case study (written or on video) involving an accident. Have each group identify safety mistakes in each situation; determine correct procedures; and present the scenario, mistakes found, and procedures which should have been used to the class.[E2, E3, E4, E5, E9, E10] • Demonstrate the uses of various hand and power tools for the class. • Provide each student with a description of a project to be completed. Have the student select the appropriate tool for the project and demonstrate its proper use to the class.[E2, E3, E4, E5, E9, E10] • Assign each student a specific set of tools (i.e., hammers, power saws, wrenches, etc.). Have students use the Internet to research and write or type (if technology resources are available) a report on the proper procedures for maintenance of the assigned set of tools.[E1, E3, E4, E5, E9, E10] **Assessment:** • Have each student complete a safety test for each specific tool. **Each student must answer 100% of questions accurately**. • Using a checklist, evaluate the case study presentation for content and delivery. • Using a checklist, evaluate the selection of the proper tool for the assigned project and demonstration of its use.

	• Evaluate the maintenance report using a checklist.

STANDARDS

Contren Learning Series Best Practices

SAF1 Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2 Explain the role that safety plays in the construction crafts.
SAF3 Describe what job-site safety means.
SAF4 Explain the appropriate safety precautions around common job-site hazards.
SAF5 Demonstrate the use and care of appropriate personal protective equipment.
SAF5 Follow safe procedures for lifting heavy objects.
SAF6 Describe safe behavior on and around ladders and scaffolds.
SAF7 Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8 Describe fire prevention and fire fighting techniques.
SAF9 Define safe work procedures around electrical hazards.
HTO1 Recognize and identify some of the basic hand tools used in the construction trade.
HTO2 Use these tools safely.
HTO3 Describe the basic procedures for taking care of these tools.
PTO1 Identify commonly used power tools of the construction trade.
PTO2 Use power tools safely.
PTO3 Explain how to maintain power tools properly.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

FASTENERS

MFF1 Identify and explain threaded fasteners.
MFF2 Identify and explain nonthreaded fasteners.
MFF3 Identify and explain insulation fasteners.
MFF4 Install fasteners.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.

MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

CUTTING AND FITTING GASKETS

MCF1 Identify and explain gasket types.
MCF2 Identify and explain gasket materials.
MCF3 Lay out and cut gaskets.
MCF4 Install gaskets.

OXY-FUEL CUTTING

MOC1 Explain oxy-fuel cutting safety.
MOC2 Identify and explain oxy-fuel cutting equipment.
MOC3 Identify and explain oxy-fuel flames.
MOC4 Identify and explain backfire and flashbacks.
MOC5 Set up oxy-fuel equipment.
MOC6 Light and adjust an oxy-fuel torch.
MOC7 Shut down oxy-fuel cutting equipment.
MOC8 Disassemble oxy-fuel equipment.
MOC9 Change empty cylinders.
MOC10 Perform housekeeping tasks.
MOC11 Perform oxy-fuel cutting:
- Straight-line and square shapes
- Piercing and slot cutting
- Bevels
- Washing
- Gouging

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.

E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.
H2 Describe the impact of science and technology on the historical development of the United States in the global community.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T3 Technology productivity tools
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Check, A., Krar, S., & Rapisarda, M. (1998). *Machine tool and manufacturing technology.* Albany, NY: Delmar.

Jeffus, L. (1999). *Welding principles and applications.* Albany, NY: Delmar.

National Center for Construction Education and Research. (1992). *Millwright level I.* Upper Saddle River, NJ: Pearson Prentice Hall.

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Walker, J. (2000). *Modern metalworking.* Tinley Park, IL: Goodheart-Willcox.

Metal Trades I
Unit 6: Basic Rigging **(8 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Explain and identify safe rigging and equipment. a. Explain and practice safe rigging. b. Identify and explain rigging equipment. c. Inspect rigging equipment.	**Teaching:** • Using industry pictures of safe rigging from Contren Core Text Unit 6, trade publications, and overheads of rigging equipment, identify, inspect and explain the techniques of safe rigging.[E8] • Students will be given scale models of rigging equipment and will practice the rigging process. • Take students on a field trip to a local industry to observe rigging procedures. Students will be divided into groups, take pictures of rigging and write/type an individual report describing their pictures, and present their report to the class.[E1, E4, E5, E9] **Assessment:** • Monitor the students as they quiz each other while working with the scale models. • The teacher will monitor the students at the field trip site and industry personnel will provide instruction on proper rigging techniques. • The written report, pictures, and presentation will be graded on content and delivery.
2. Discuss the proper use of load-handling and signaling practices. a. Discuss the proper procedures for estimating size, weight, and center of gravity. b. Simulate rigging and moving materials and equipment.	**Teaching:** • Discuss procedures for handling a load. Provide the proper hand signals for moving the load. Provide the correct procedures to move rig and move materials and equipment. Utilize activities in Rigging Unit of the Contren Core Text. **Assessment:** • Assess the discussion using teacher observation to monitor the activity. • Assess the Contren activities from the materials provided.

STANDARDS

Contren Learning Series Best Practices

SAF1 Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2 Explain the role that safety plays in the construction crafts.
SAF3 Describe what job-site safety means.
SAF4 Explain the appropriate safety precautions around common job-site hazards.
SAF5 Demonstrate the use and care of appropriate personal protective equipment.
SAF5 Follow safe procedures for lifting heavy objects.
SAF6 Describe safe behavior on and around ladders and scaffolds.
SAF7 Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8 Describe fire prevention and fire fighting techniques.
SAF9 Define safe work procedures around electrical hazards.
MAT1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2 Use a standard ruler and a metric ruler to measure.
MAT3 Add, subtract, multiply, and divide fractions.
MAT4 Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5 Convert decimals to percents and percents to decimals.
MAT6 Convert fractions to decimals and decimals to fractions.
MAT7 Explain what the metric system is and how it is important in the construction trade.
MAT8 Recognize and use metric units of length, weight, volume, and temperature.
MAT9 Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
RIG1 Identify and describe the use of slings and common rigging hardware.
RIG2 Describe the basic inspection techniques and rejection criteria used for slings and hardware.
RIG3 Describe the basic hitch configurations and their proper connections.
RIG4 Describe basic load-handling safety practices.
RIG5 Demonstrate proper use of American National Standards Institute (ANSI) hand signals.

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Check, A., Krar, S., & Rapisarda, M. (1998). *Machine tool and manufacturing technology.* Albany, NY: Delmar.

Jeffus, L. (1999). *Welding principles and applications.* Albany, NY: Delmar.

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Walker, J. (2000). *Modern metalworking.* Tinley Park, IL: Goodheart-Willcox.

Metal Trades I
Unit 7: Millwright **(58 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Explain and demonstrate the safe use and maintenance of millwright hand tools. a. Identify and discuss the use of millwright tools. b. Discuss rules of safety. c. Demonstrate the use of millwright tools. d. Explain the procedures for maintenance.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following tasks before performing a task.** • Identify basic millwright hand tools (e.g., taper plug gages, reamers, drift pins, etc.). • Discuss safety factors, proper use, and maintenance. • Describe accidents that can occur while using these tools. • Demonstrate the use of each millwright tool for the students. • Provide each student with a description of a project to be completed. Have the students select the proper tool for the job and demonstrate its proper use to the class. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A

	rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Explore millwright fasteners. a. Identify and install threaded and non-threaded fasteners and insulation fasteners.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following tasks before performing a task.** • Identify and install the following: o Thread standards o Thread series o Thread class o Thread designation o Thread design • Identify fastener grade markings and how they are standardized. • Identify the following types of threaded fasteners and their uses. o Machine screws o Machine bolts o Cap screws o Set screws o Stud bolts o Tread-forming screws o Thread-cutting screws o Drive screws o Eyebolts o Toggle bolts o Anchor bolts o Self-tapping bolts o Nuts o Torn nuts o Castellated, slotted, and self-locking nuts o Acorn nuts o Wing nuts o Inserts o Flat washers o Lock washers • split-ring lock • external • internal • internal-external • counter

3. Explain and install the types of retainer rings.	**Teaching:**
	The instructor will explain and demonstrate the following tasks. The students will demonstrate the following tasks before performing a task.
	• Identify the types of keys:
	  o Square key
	  o Pratt and Whitney key
	  o Gibb head key
	  o Woodruff key
	• Identify the types of pins:
	  o Dowel pins
	  o Taper and spring pins
	  o Cutter pins
	• Identify the types of rivets:
	  o Tinners rivet
	  o Blind rivet
	• Identify the various types of:
	  o Annealed wire
	  o Bands and clips
	  o Staples
	  o Stick clips
	  o Studs and pins
	  • Copper clad
	  • Stainless steel
	  • Aluminum
	  o Bonding adhesives
	  • Contact
	  • Non-contact
	
	Assessment:
	• A written test will be given for the terminology.
	• A checklist will be used to observe the students while they are performing safety inspections and procedures for operation to complete a given task.

4. Identify and describe layout and scribe procedures. a. Identify and explain layout tools. b. Lay out base lines (arc method). c. Lay out base lines (3-4-5 method). d. Scribe straight lines. e. Scribe perpendicular lines to a base line using a square. f. Scribe perpendicular lines to an edge	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following tasks before performing a task.** • Identify and explain layout tools. • Lay out base lines (arc method). • Lay out base lines (3-4-5 method). • Scribe straight lines.

using a combination square. g. Scribe angled lines using a combination square. h. Scribe angled lines using a protractor. i. Scribe circles using dividers. j. Scribe circles using trammel points. k. Scribe perpendicular lines from a base line using dividers. l. Scribe perpendicular lines from base lines using reference points. m. Bisect lines using dividers. n. Divide lines into equal parts. o. Divide circles into equal parts. p. Lay out experiment locations.	• Scribe perpendicular lines to a base line using a square. • Scribe perpendicular lines to an edge using a combination square. • Scribe angled lines using a combination square. • Scribe angled lines using a protractor. • Scribe circles using dividers. • Scribe circles using trammel points. • Scribe perpendicular lines from a base line using dividers. • Scribe perpendicular lines from base lines using reference points. • Bisect lines using dividers. • Divide lines into equal parts. • Divide circles into equal parts. • Lay out experiment locations. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and operation procedures to complete a given task. (Baselines must belaid out to the proper angle ± 5°; all scribe lines must satisfy instructor; equipment must log out to ½".)

STANDARDS

Contren Learning Series Best Practices

SAF1 Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2 Explain the role that safety plays in the construction crafts.
SAF3 Describe what job-site safety means.
SAF4 Explain the appropriate safety precautions around common job-site hazards.
SAF5 Demonstrate the use and care of appropriate personal protective equipment.
SAF5 Follow safe procedures for lifting heavy objects.
SAF6 Describe safe behavior on and around ladders and scaffolds.
SAF7 Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8 Describe fire prevention and fire fighting techniques.
SAF9 Define safe work procedures around electrical hazards.
MAT1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2 Use a standard ruler and a metric ruler to measure.

MAT3 Add, subtract, multiply, and divide fractions.
MAT4 Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5 Convert decimals to percents and percents to decimals.
MAT6 Convert fractions to decimals and decimals to fractions.
MAT7 Explain what the metric system is and how it is important in the construction trade.
MAT8 Recognize and use metric units of length, weight, volume, and temperature.
MAT9 Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1 Recognize and identify some of the basic hand tools used in the construction trade.
HTO2 Use these tools safely.
HTO3 Describe the basic procedures for taking care of these tools.
PTO1 Identify commonly used power tools of the construction trade.
PTO2 Use power tools safely.
PTO3 Explain how to maintain power tools properly.
BLU1 Recognize and identify basic blueprint terms, components, and symbols.
BLU2 Relate information on blueprints to actual locations on the print.
BLU3 Recognize different classifications of drawings.
BLU4 Interpret and use drawing dimensions.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

FASTENERS

MFF1 Identify and explain threaded fasteners.
MFF2 Identify and explain nonthreaded fasteners.
MFF3 Identify and explain insulation fasteners.
MFF4 Install fasteners.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.

MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

CUTTING AND FITTING GASKETS

MCF1 Identify and explain gasket types.
MCF2 Identify and explain gasket materials.
MCF3 Lay out and cut gaskets.
MCF4 Install gaskets.

OXY-FUEL CUTTING

MOC1 Explain oxy-fuel cutting safety.
MOC2 Identify and explain oxy-fuel cutting equipment.
MOC3 Identify and explain oxy-fuel flames.
MOC4 Identify and explain backfire and flashbacks.
MOC5 Set up oxy-fuel equipment.
MOC6 Light and adjust an oxy-fuel torch.
MOC7 Shut down oxy-fuel cutting equipment.
MOC8 Disassemble oxy-fuel equipment.
MOC9 Change empty cylinders.
MOC10 Perform housekeeping tasks.
MOC11 Perform oxy-fuel cutting:
- Straight-line and square shapes
- Piercing and slot cutting
- Bevels
- Washing
- Gouging

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.

E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

National Center for Construction Education and Research. (1992). *Millwright level I.* Upper Saddle River, NJ: Pearson Prentice Hall.

National Center for Construction Education and Research. (1993). *Millwright level II.* Upper Saddle River, NJ: Pearson Prentice Hall.

National Center for Construction Education and Research. (2004). *Core curriculum.* Upper Saddle River, NJ: Pearson Prentice Hall.

Metal Trades I
Unit 8: Power Saws and Drilling Machines (24.0 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Identify and describe the safe operation of the types of power saws. a. Identify and describe rules for safe use of power saws. b. Describe factors that determine saw blade selection. c. Describe factors to consider in the care and cleaning of power saws. d. Lay out and cut stock with a band saw according to specifications.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Identify and describe the types of drilling machines, including hand powered and drill press, and the rules for safe operation of each. a. Describe safety rules for the safe use of a hand power drill and drill press. b. Identify work-holding and setup devices in drill press operations. c. Lay out holes and drill, ream, countersink, and counter bore according to project specifications.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following tasks before performing a task.** • Describe safety rules for the safe use of a hand power drill and drill press. • Identify work-holding and setup devices in drill press operations. • Lay out holes and drill, ream, countersink, and counter bore according to project

	specifications. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and operation procedures to complete a given task.

STANDARDS

Contren Learning Series Best Practices

SAF1 Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2 Explain the role that safety plays in the construction crafts.
SAF3 Describe what job-site safety means.
SAF4 Explain the appropriate safety precautions around common job-site hazards.
SAF5 Demonstrate the use and care of appropriate personal protective equipment.
SAF5 Follow safe procedures for lifting heavy objects.
SAF6 Describe safe behavior on and around ladders and scaffolds.
SAF7 Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8 Describe fire prevention and fire fighting techniques.
SAF9 Define safe work procedures around electrical hazards.
HTO1 Recognize and identify some of the basic hand tools used in the construction trade.
HTO2 Use these tools safely.
HTO3 Describe the basic procedures for taking care of these tools.
PTO1 Identify commonly used power tools of the construction trade.
PTO2 Use power tools safely.
PTO3 Explain how to maintain power tools properly.
BLU1 Recognize and identify basic blueprint terms, components, and symbols.
BLU2 Relate information on blueprints to actual locations on the print.
BLU3 Recognize different classifications of drawings.
BLU4 Interpret and use drawing dimensions.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

FASTENERS

MFF1 Identify and explain threaded fasteners.
MFF2 Identify and explain nonthreaded fasteners.
MFF3 Identify and explain insulation fasteners.

MFF4 Install fasteners.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

CUTTING AND FITTING GASKETS

MCF1 Identify and explain gasket types.
MCF2 Identify and explain gasket materials.
MCF3 Lay out and cut gaskets.
MCF4 Install gaskets.

OXY-FUEL CUTTING

MOC1 Explain oxy-fuel cutting safety.
MOC2 Identify and explain oxy-fuel cutting equipment.
MOC3 Identify and explain oxy-fuel flames.
MOC4 Identify and explain backfire and flashbacks.
MOC5 Set up oxy-fuel equipment.
MOC6 Light and adjust an oxy-fuel torch.
MOC7 Shut down oxy-fuel cutting equipment.
MOC8 Disassemble oxy-fuel equipment.
MOC9 Change empty cylinders.
MOC10 Perform housekeeping tasks.
MOC11 Perform oxy-fuel cutting:
- Straight-line and square shapes
- Piercing and slot cutting
- Bevels
- Washing
- Gouging

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T3 Technology productivity tools
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Check, A., Krar, S., & Rapisarda, M. (1998). *Machine tool and manufacturing technology.* Albany, NY: Delmar.

Jeffus, L. (1999). *Welding principles and applications.* Albany, NY: Delmar.

National Center for Construction Education and Research. (1992). *Millwright level I.* Upper Saddle River, NJ: Pearson Prentice Hall.

National Center for Construction Education and Research. (1993). *Millwright level II.* Upper Saddle River, NJ: Pearson Prentice Hall.

National Center for Construction Education and Research. (2001). *Sheet Metal level I.* Upper Saddle River, NJ: Pearson Prentice Hall.

National Center for Construction Education and Research. (2001). *Welding level I.* Upper Saddle River, NJ: Pearson Prentice Hall.

National Center for Construction Education and Research. (2001). *Welding level II.* Upper Saddle River, NJ: Pearson Prentice Hall.

National Center for Construction Education and Research. (2004). *Core curriculum.* Upper Saddle River, NJ: Pearson Prentice Hall.

Taylor, D. (1996). *Elementary blueprint reading for machinists* (4th ed.). Albany, NY: Delmar.

Walker, J. (2000). *Modern metalworking.* Tinley Park, IL: Goodheart-Willcox.

Metal Trades I
Unit 9: Basic Welding **(25 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Identify and describe the basic equipment, setup, and safety rules for proper use of equipment and prepare base metal for welding (SMAW and GMAW), oxy-fuel welding, and brazing. a. Identify and explain joint design and considerations. b. Prepare base metal joints for welding, oxy-fuel welding, and brazing.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task. The student will identify various materials and processes to prepare the materials for individual welding procedures. A checklist will be used for evaluation.
2. Perform various operations of welding, oxy-fuel welding, and brazing using the proper equipment. a. Welding (SMAW) - Strike and maintain arc, run stringer beads; build a pad; perform fillet welds in the flat position on a T-joint. b. Welding (GMAW) - Start and maintain arc; run stringer beads; build a pad; perform fillet welds in	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following tasks before performing live work.** • Welding (SMAW) - Strike and maintain arc; run stringer beads; build a pad; perform fillet welds in the flat position on a T-joint. • Welding (GMAW) - Start and maintain arc; run stringer beads; build a pad; perform fillet

the flat position on a T-joint. c. Oxy-fuel fusion welding in the flat position. d. Brazing in the flat position.	welds in the flat position on a T-joint. • Oxy-fuel fusion welding in the flat position. • Brazing in the flat position. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and operation procedures to complete a given task.

STANDARDS

Contren Learning Series Best Practices

SAF1	Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2	Explain the role that safety plays in the construction crafts.
SAF3	Describe what job-site safety means.
SAF4	Explain the appropriate safety precautions around common job-site hazards.
SAF5	Demonstrate the use and care of appropriate personal protective equipment.
SAF5	Follow safe procedures for lifting heavy objects.
SAF6	Describe safe behavior on and around ladders and scaffolds.
SAF7	Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8	Describe fire prevention and fire fighting techniques.
SAF9	Define safe work procedures around electrical hazards.
MAT1	Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2	Use a standard ruler and a metric ruler to measure.
MAT3	Add, subtract, multiply, and divide fractions.
MAT4	Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5	Convert decimals to percents and percents to decimals.
MAT6	Convert fractions to decimals and decimals to fractions.
MAT7	Explain what the metric system is and how it is important in the construction trade.
MAT8	Recognize and use metric units of length, weight, volume, and temperature.
MAT9	Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1	Recognize and identify some of the basic hand tools used in the construction trade.
HTO2	Use these tools safely.
HTO3	Describe the basic procedures for taking care of these tools.
PTO1	Identify commonly used power tools of the construction trade.
PTO2	Use power tools safely.
PTO3	Explain how to maintain power tools properly.
BLU1	Recognize and identify basic blueprint terms, components, and symbols.
BLU2	Relate information on blueprints to actual locations on the print.
BLU3	Recognize different classifications of drawings.

BLU4 Interpret and use drawing dimensions.
RIG1 Identify and describe the use of slings and common rigging hardware.
RIG2 Describe the basic inspection techniques and rejection criteria used for slings and hardware.
RIG3 Describe the basic hitch configurations and their proper connections.
RIG4 Describe basic load-handling safety practices.
RIG5 Demonstrate proper use of American National Standards Institute (ANSI) hand signals.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

OXY-FUEL CUTTING

MOC1 Explain oxy-fuel cutting safety.
MOC2 Identify and explain oxy-fuel cutting equipment.
MOC3 Identify and explain oxy-fuel flames.
MOC4 Identify and explain backfire and flashbacks.
MOC5 Set up oxy-fuel equipment.
MOC6 Light and adjust an oxy-fuel torch.
MOC7 Shut down oxy-fuel cutting equipment.
MOC8 Disassemble oxy-fuel equipment.
MOC9 Change empty cylinders.
MOC10 Perform housekeeping tasks.
MOC11 Perform oxy-fuel cutting:
- Straight-line and square shapes
- Piercing and slot cutting

- Bevels
- Washing
- Gouging

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Jeffus, L. (1999). *Welding principles and applications.* Albany, NY: Delmar.

National Center for Construction Education and Research. (2001). *Welding level I.* Upper Saddle River, NJ: Pearson Prentice Hall.

National Center for Construction Education and Research. (2001). *Welding level II.* Upper Saddle River, NJ: Pearson Prentice Hall.

National Center for Construction Education and Research. (2004). *Core curriculum.* Upper Saddle River, NJ: Pearson Prentice Hall.

Taylor, D. (1996). *Elementary blueprint reading for machinists* (4th ed.). Albany, NY: Delmar.

Walker, J. (2000). *Modern metalworking.* Tinley Park, IL: Goodheart-Willcox.

Metal Trades I
Unit 10: Basic Machine Shop **(25 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Identify and describe safety rules that apply to the pedestal grinder, and perform inspection, maintenance, and grinding operations. a. Describe safety rules that apply to the pedestal grinder. b. Inspect and maintain a pedestal grinder.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Identify and compare shapes of single-point, carbide, and high speed steel cutting tools. a. Perform a free-hand grinding of a turning tool, facing tool, and 60-degree threading tool.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following tasks before performing live work.** • Identify the terminology and parts of sheet metal equipment and accessories. • Identify and compare basic shapes of single-point cutting tools. • Free-hand grind a turning tool, facing tool, and 60-degree threading tool; and sharpen a

	cutoff tool blade to specifications. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and operation procedures to complete a given task.
3. Identify safety rules and components of an engine lathe.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following tasks before performing live work.** • Identify the terminology and parts of sheet metal equipment and accessories. • Identify the components of an engine lathe and the function of each part. • Describe the basic operations performed on a lathe. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and operation procedures to complete a given task.
4. Remove and install a lathe chuck, and perform lathe operations using carbide inserts.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following tasks before performing live work.** • Identify the terminology and parts of sheet metal equipment and accessories. • Remove and install a lathe chuck following manufacturer's recommendations and perform a facing operation, face a part to length, perform a straight turning operation, turn a part with square shoulder to length, and perform a center-drilling operation according to layout specifications. • Turn threads to specifications.

	Assessment: • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and operation procedures to complete a given task.

STANDARDS

Contren Learning Series Best Practices

SAF1	Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2	Explain the role that safety plays in the construction crafts.
SAF3	Describe what job-site safety means.
SAF4	Explain the appropriate safety precautions around common job-site hazards.
SAF5	Demonstrate the use and care of appropriate personal protective equipment.
SAF5	Follow safe procedures for lifting heavy objects.
SAF6	Describe safe behavior on and around ladders and scaffolds.
SAF7	Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8	Describe fire prevention and fire fighting techniques.
SAF9	Define safe work procedures around electrical hazards.
MAT1	Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2	Use a standard ruler and a metric ruler to measure.
MAT3	Add, subtract, multiply, and divide fractions.
MAT4	Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5	Convert decimals to percents and percents to decimals.
MAT6	Convert fractions to decimals and decimals to fractions.
MAT7	Explain what the metric system is and how it is important in the construction trade.
MAT8	Recognize and use metric units of length, weight, volume, and temperature.
MAT9	Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1	Recognize and identify some of the basic hand tools used in the construction trade.
HTO2	Use these tools safely.
HTO3	Describe the basic procedures for taking care of these tools.
PTO1	Identify commonly used power tools of the construction trade.
PTO2	Use power tools safely.
PTO3	Explain how to maintain power tools properly.
BLU1	Recognize and identify basic blueprint terms, components, and symbols.
BLU2	Relate information on blueprints to actual locations on the print.
BLU3	Recognize different classifications of drawings.
BLU4	Interpret and use drawing dimensions.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

CUTTING AND FITTING GASKETS

MCF1 Identify and explain gasket types.
MCF2 Identify and explain gasket materials.
MCF3 Lay out and cut gaskets.
MCF4 Install gaskets.

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.

E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Check, A., Krar, S., & Rapisarda, M. (1998). *Machine tool and manufacturing technology.* Albany, NY: Delmar.

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Metal Trades I
Unit 11: Introduction to Sheet Metal (10 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Identify and describe various fasteners, hangers, supports, hand tools, sheet metal machines, and terms. a. Identify and describe the safe use of specialized hand tools and machines. b. Identify common seams, locks, edges, and notches. c. Describe the major fasteners used in sheet metal projects. d. Describe the major hangers used in sheet metal. e. Describe the major supports used in sheet metal.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Fabricate assigned sheet metal projects.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following before performing tasks.** • Identify the terminology and parts of sheet metal equipment and accessories. • Fabricate metal rectangles, metal circles, form cylinders, a simple box, and straight duct to specifications; fabricate 90 degree (square throat and heel), 90 degree elbow

	(radius throat and heel), and simple offset. • Fold, bend, hem, and make drive clips on a hand brake according to specifications. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and operation procedures to complete a given task.

STANDARDS

Contren Learning Series Best Practices

SAF1	Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2	Explain the role that safety plays in the construction crafts.
SAF3	Describe what job-site safety means.
SAF4	Explain the appropriate safety precautions around common job-site hazards.
SAF5	Demonstrate the use and care of appropriate personal protective equipment.
SAF5	Follow safe procedures for lifting heavy objects.
SAF6	Describe safe behavior on and around ladders and scaffolds.
SAF7	Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8	Describe fire prevention and fire fighting techniques.
SAF9	Define safe work procedures around electrical hazards.
MAT1	Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2	Use a standard ruler and a metric ruler to measure.
MAT3	Add, subtract, multiply, and divide fractions.
MAT4	Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5	Convert decimals to percents and percents to decimals.
MAT6	Convert fractions to decimals and decimals to fractions.
MAT7	Explain what the metric system is and how it is important in the construction trade.
MAT8	Recognize and use metric units of length, weight, volume, and temperature.
MAT9	Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1	Recognize and identify some of the basic hand tools used in the construction trade.
HTO2	Use these tools safely.
HTO3	Describe the basic procedures for taking care of these tools.
PTO1	Identify commonly used power tools of the construction trade.
PTO2	Use power tools safely.
PTO3	Explain how to maintain power tools properly.
BLU1	Recognize and identify basic blueprint terms, components, and symbols.
BLU2	Relate information on blueprints to actual locations on the print.
BLU3	Recognize different classifications of drawings.

BLU4 Interpret and use drawing dimensions.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

FASTENERS

MFF1 Identify and explain threaded fasteners.
MFF2 Identify and explain nonthreaded fasteners.
MFF3 Identify and explain insulation fasteners.
MFF4 Install fasteners.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

CUTTING AND FITTING GASKETS

MCF1 Identify and explain gasket types.
MCF2 Identify and explain gasket materials.
MCF3 Lay out and cut gaskets.
MCF4 Install gaskets.

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.

E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Check, A., Krar, S., & Rapisarda, M. (1998). *Machine tool and manufacturing technology.* Albany, NY: Delmar.

Jeffus, L. (1999). *Welding principles and applications.* Albany, NY: Delmar.

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Metal Trades II (Advanced Welding Option)
Unit A1: Orientation, Advanced Leadership, and Employability Skills (10 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe local program and vocational center policies and procedures. a. Describe local program and vocational center policies and procedures including dress code, attendance, academic requirements, discipline, and transportation regulations.	**Teaching:** • Present local program and vocational center policies and procedures. • Students will read the handbook to become aware of what is expected of them in relation to the policies and procedures of the school. This will include dress code, attendance, academic requirements, discipline, and transportation regulations. Students will work together in pairs. A student with a higher reading ability will team up with a student with a lower reading ability to get a better understanding of the school's program, policies and procedures.[E2, E3, E8] **Assessment:** • Students will have a test on applicable policies and procedures. • Students will submit a written report on rules and regulations. • Explanation of local student handbook requirements. • Students will complete exercises to identify equipment and functions found in the school lab. • Assess student orientation knowledge through instructor observations and written unit test. File completed test to document student mastery of the school and program policies and procedures.
2. Describe employment opportunities and responsibilities. a. Describe employment opportunities including potential earnings, employee benefits, job availability, place of employment, working conditions, and educational requirements. b. Describe basic employee responsibilities. c. Design a resume and complete a job application.	**Teaching:** • Use the Contren Series Core Text, Basic Employability Skills Unit and Welding Level I, Orientation to the Trade Unit to define trade terms related to basic employability skills. Discuss the chapter and perform the related activities to promote awareness of employability skills.[E2] • The instructor will explain the contents of a cover letter and resume. Examples of cover

	letters and resumes will be given to the students. The student will design a cover letter and resume. • The instructor will discuss a job application. The student will obtain and complete a job application from a local business. • Students will use career software, such as Choices, to measure their aptitudes and abilities for particular careers.[E3, E8] • Students will use the Internet to research a list of careers for which they will be qualified upon program completion.[E2, E3, E4, E5, E10] • Students will use available resources (college catalogs and college websites) to research information about postsecondary educational opportunities.[E2, E3, E4, E5, E10] • Students will select a career in the field and outline educational and skill requirements, expected job growth, and entry-level salaries.[E1, E3, E8, E9] **Assessment:** • Assessment will be determined by matching test for definitions and the level of success regarding the Contren activities. Lessons involving writing and math skills will be integrated with the appropriate department. • Use a checklist to evaluate the resume and cover letter. • A rubric will be used to evaluate the job application. • Use a checklist to evaluate the presentation. • Review career software printout to assess student aptitudes and abilities.
3. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA. a. Demonstrate effective teambuilding and leadership skills. b. Practice appropriate work ethics.	**Teaching:** • Discuss the role of a team member and leader. Assign the students roles within a team and have them role play a situation in which there is a conflict which must be resolved. Utilize the lessons from SkillsUSA, Contren Tools for Success, or other resources to provide additional training.[E3, E8]

	• Discuss appropriate work ethics standards. Have the students list what they believe to be the most common problems within the metal trades profession. **Assessment:** • Assess the role play using a checklist for documentation. • Lessons from other resources should be assessed according to the recommended resource guide.
4. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations.	**Teaching:** • Have the students perform an activity involving verbal instructions. Divide the students into groups and have one team be the customer and the other be the contractor. The customer will describe the project and the contractor will have to provide a brief plan for the construction of the project. Have the groups switch roles and the customer will provide the contractor with a written plan and blueprint. The contractor will describe the procedure for construction of the project.[E2, E3, E4, E8] **Assessment:** • The lesson will be assessed using a rubric and a checklist for the written projects.

STANDARDS

Contren Learning Series Best Practices

SAF1 Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2 Explain the role that safety plays in the construction crafts.
SAF3 Describe what job-site safety means.
SAF4 Explain the appropriate safety precautions around common job-site hazards.
SAF5 Demonstrate the use and care of appropriate personal protective equipment.
SAF5 Follow safe procedures for lifting heavy objects.
SAF6 Describe safe behavior on and around ladders and scaffolds.
SAF7 Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8 Describe fire prevention and fire fighting techniques.
SAF9 Define safe work procedures around electrical hazards.
MAT1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.

MAT2 Use a standard ruler and a metric ruler to measure.
MAT3 Add, subtract, multiply, and divide fractions.
MAT4 Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5 Convert decimals to percents and percents to decimals.
MAT6 Convert fractions to decimals and decimals to fractions.
MAT7 Explain what the metric system is and how it is important in the construction trade.
MAT8 Recognize and use metric units of length, weight, volume, and temperature.
MAT9 Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1 Recognize and identify some of the basic hand tools used in the construction trade.
HTO2 Use these tools safely.
HTO3 Describe the basic procedures for taking care of these tools.
PTO1 Identify commonly used power tools of the construction trade.
PTO2 Use power tools safely.
PTO3 Explain how to maintain power tools properly.
BLU1 Recognize and identify basic blueprint terms, components, and symbols.
BLU2 Relate information on blueprints to actual locations on the print.
BLU3 Recognize different classifications of drawings.
BLU4 Interpret and use drawing dimensions.
RIG1 Identify and describe the use of slings and common rigging hardware.
RIG2 Describe the basic inspection techniques and rejection criteria used for slings and hardware.
RIG3 Describe the basic hitch configurations and their proper connections.
RIG4 Describe basic load-handling safety practices.
RIG5 Demonstrate proper use of American National Standards Institute (ANSI) hand signals.
COM1 Demonstrate the ability to understand information and instructions that are presented in both written and verbal form.
COM2 Demonstrate the ability to communicate effectively in on-the-job situations using written and verbal skills.
EMP1 Explain the construction industry, the role of the companies that make up the industry, and the role of individual professionals in the industry.
EMP2 Demonstrate critical thinking skills and the ability to solve problems using those skills.
EMP3 Demonstrate knowledge of computer systems and explain common uses for computers in the construction industry.
EMP4 Demonstrate effective relationship skills with teammates and supervisors, exhibit the ability to work on a team, and demonstrate appropriate leadership skills.
EMP5 Be aware of workplace issues such as sexual harassment, stress, and substance abuse.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

FASTENERS

MFF1 Identify and explain threaded fasteners.
MFF2 Identify and explain nonthreaded fasteners.

MFF3 Identify and explain insulation fasteners.
MFF4 Install fasteners.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
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MBL4 Scribe straight lines.
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MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

CUTTING AND FITTING GASKETS

MCF1 Identify and explain gasket types.
MCF2 Identify and explain gasket materials.
MCF3 Lay out and cut gaskets.
MCF4 Install gaskets.

OXY-FUEL CUTTING

MOC1 Explain oxy-fuel cutting safety.
MOC2 Identify and explain oxy-fuel cutting equipment.
MOC3 Identify and explain oxy-fuel flames.
MOC4 Identify and explain backfire and flashbacks.
MOC5 Set up oxy-fuel equipment.
MOC6 Light and adjust an oxy-fuel torch.
MOC7 Shut down oxy-fuel cutting equipment.
MOC8 Disassemble oxy-fuel equipment.
MOC9 Change empty cylinders.
MOC10 Perform housekeeping tasks.
MOC11 Perform oxy-fuel cutting:
- Straight-line and square shapes
- Piercing and slot cutting
- Bevels
- Washing
- Gouging

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
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Workplace Skills for the 21st Century

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
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T6 Technology problem-solving and decision-making tools

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Metal Trades II (Advanced Welding Options)
Unit A2: Basic Safety **(8 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe general safety rules for working in a shop/lab and industry. a. Describe how to avoid on-site accidents. b. Explain the relationship between housekeeping and safety. c. Explain the importance of following all safety rules and company safety policies. d. Explain the importance of reporting all on-the-job injuries, accidents, and near misses. e. Explain the need for evacuation policies and the importance of following them. f. Explain the employer's substances abuse policy and how it relates to safety. g. Explain the safety procedures when working near pressurized or high temperature.	**Teaching:** **This can be used for the entire unit.** • Identify, discuss, and demonstrate terms, rules, and procedures related to shop/lab and industry safety (Contren Core Text Basic Safety Unit and Level I Orientation to the Trade Unit).[E3, E8] • Required written tests will follow each section of guidelines for safety rules and procedures. • Provide the students with a list of terms and have them define the terms. Pair the students to quiz each other on the definitions in preparation for a written exam.[E2, E3, E4, E8] • Using the guidelines provided for personal safety (i.e., clothing, jewelry, hair, eyes, and ears), divide the students into pairs and assign each pair one of the guidelines. Each pair will demonstrate the "do's and don'ts" of the assigned guideline. • Have an industry speaker present to the class on the necessity of safety in the work environment. The students will write a summary of the presentation.[E1, E2, E9] • Divide the students into teams and have them develop scenarios of hazards and accidents using the Contren Series Core Text, Basic Safety Unit and Level I Orientation to the Trade Unit, trade publications, and the Internet. This will include tools, spills, working around welding, improper use of barriers, ladders or scaffolds, use of MSDS information, fires, and electrical situations. In a game type situation, one team will read a scenario and the other teams will compete to be the first to provide the proper safety measures which should have been used to prevent the hazardous situation or accident. Points will be awarded to the teams with the correct answers.[E2, E4]
2. Identify and apply safety around metal trades operations. a. Use proper safety practices when welding or working around metal trades operations. b. Use proper safety practices when welding in or near trenches and excavations. c. Explain the term *proximity work*.	
3. Identify and explain use of various barriers and confinements. a. Explain the safety requirements for working in confined areas. b. Explain and practice lockout/tagout procedures. c. Explain the different barriers and barricades and how they are used. d. Recognize and explain personal protective equipment. e. Inspect and care for personal protective equipment.	

4. Explain lifting and the use of ladders and scaffolds. a. Identify and explain the procedures for lifting heavy objects. b. Inspect and safely work with various ladders and scaffolds.	• Required written tests will follow each section of guidelines for safety rules and procedures. • NOTE: SAFETY IS TO BE TAUGHT AS AN ONGOING PART OF THE COURSE THROUGHOUT THE YEAR. **Assessment:** • Student participation will be monitored by the instructor and the written exam will be graded. Students must achieve 100% accuracy. • The "do's and don'ts" exercise will be critiqued with a peer review. • The summary of the speaker's presentation will be critiqued using a rubric. • The teams will be rewarded according to the points earned from the game. This could be extra points, classroom privileges, etc. • Written exams will be graded.
5. Explain the Material Safety Data Sheet (MSDS). a. Explain the function of the MSDS. b. Interpret the requirements of the MSDS.	
6. Explain fires. a. Explain the process by which fires start. b. Explain fire prevention of various flammable liquids. c. Explain the classes of fire and the types of extinguishers.	
7. Explain safety in and around electrical situations. a. Explain injuries when electrical contact occurs. b. Explain safety around electrical hazards. c. Explain action to take when an electrical shock occurs.	

STANDARDS

Contren Learning Series Best Practices

SAF1 Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2 Explain the role that safety plays in the construction crafts.
SAF3 Describe what job-site safety means.
SAF4 Explain the appropriate safety precautions around common job-site hazards.
SAF5 Demonstrate the use and care of appropriate personal protective equipment.
SAF5 Follow safe procedures for lifting heavy objects.
SAF6 Describe safe behavior on and around ladders and scaffolds.
SAF7 Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8 Describe fire prevention and fire fighting techniques.
SAF9 Define safe work procedures around electrical hazards.
MAT1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2 Use a standard ruler and a metric ruler to measure.
MAT3 Add, subtract, multiply, and divide fractions.
MAT4 Add, subtract, multiply, and divide decimals, with and without a calculator.

MAT5 Convert decimals to percents and percents to decimals.
MAT6 Convert fractions to decimals and decimals to fractions.
MAT7 Explain what the metric system is and how it is important in the construction trade.
MAT8 Recognize and use metric units of length, weight, volume, and temperature.
MAT9 Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1 Recognize and identify some of the basic hand tools used in the construction trade.
HTO2 Use these tools safely.
HTO3 Describe the basic procedures for taking care of these tools.
PTO1 Identify commonly used power tools of the construction trade.
PTO2 Use power tools safely.
PTO3 Explain how to maintain power tools properly.
BLU1 Recognize and identify basic blueprint terms, components, and symbols.
BLU2 Relate information on blueprints to actual locations on the print.
BLU3 Recognize different classifications of drawings.
BLU4 Interpret and use drawing dimensions.
RIG1 Identify and describe the use of slings and common rigging hardware.
RIG2 Describe the basic inspection techniques and rejection criteria used for slings and hardware.
RIG3 Describe the basic hitch configurations and their proper connections.
RIG4 Describe basic load-handling safety practices.
RIG5 Demonstrate proper use of American National Standards Institute (ANSI) hand signals.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

FASTENERS

MFF1 Identify and explain threaded fasteners.
MFF2 Identify and explain nonthreaded fasteners.
MFF3 Identify and explain insulation fasteners.
MFF4 Install fasteners.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.

MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

CUTTING AND FITTING GASKETS

MCF1 Identify and explain gasket types.
MCF2 Identify and explain gasket materials.
MCF3 Lay out and cut gaskets.
MCF4 Install gaskets.

OXY-FUEL CUTTING

MOC1 Explain oxy-fuel cutting safety.
MOC2 Identify and explain oxy-fuel cutting equipment.
MOC3 Identify and explain oxy-fuel flames.
MOC4 Identify and explain backfire and flashbacks.
MOC5 Set up oxy-fuel equipment.
MOC6 Light and adjust an oxy-fuel torch.
MOC7 Shut down oxy-fuel cutting equipment.
MOC8 Disassemble oxy-fuel equipment.
MOC9 Change empty cylinders.
MOC10 Perform housekeeping tasks.
MOC11 Perform oxy-fuel cutting:
- Straight-line and square shapes
- Piercing and slot cutting
- Bevels
- Washing
- Gouging

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.

E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.

Workplace Skills for the 21st Century

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Check, A., Krar, S., & Rapisarda, M. (1998). *Machine tool and manufacturing technology.* Albany, NY: Delmar.

Jeffus, L. (1999). *Welding principles and applications.* Albany, NY: Delmar.

National Center for Construction Education and Research. (1992). *Millwright level I.* Upper Saddle River, NJ: Pearson Prentice Hall.

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Walker, J. (2000). *Modern metalworking.* Tinley Park, IL: Goodheart-Willcox.

Metal Trades II (Advanced Welding Options)
Unit A3: Shielded Metal Arc Welding (SMAW) **(112 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Identify and explain safety, setup, weld cleanup, and maintenance of arc welding equipment.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Identify and use procedures for joint fit-up and alignment. a. Identify and explain job code specifications. b. Use fit-up gauges and measuring devices to check joint fit up. c. Use plate fit-up tools to fit-up joints. d. Identify and explain distortion and how it is controlled. e. Check for joint misalignment and poor fit-up.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following before performing tasks.** • Identify and explain job code specifications. • Use fit-up gauges and measuring devices to check joint fit up. • Use plate fit-up tools to fit-up joints. • Identify and explain distortion and how it is

	controlled. • Check for joint misalignment and poor fit-up. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the studens while they are performing safety inspections and operation procedures to complete a given task.
3. Identify and explain filler metal and selection of electrodes. a. Identify and explain AWS/ASME filler metal classification system. b. Explain the storage and control of filler metals.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following before performing tasks.** • Identify and explain AWS/ASME filler metal classification system. • Explain the storage and control of filler metals. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and operation procedures to complete a given task.
4. Construct various welds using different positions and electrodes. a. Weld beads on plate in the flat position using E6010 and E7018 electrodes. b. Make fillet welds in the horizontal position using E6010 and E7018 electrodes. c. Make fillet welds in the vertical position using E6010 and E7018 electrodes. d. Make fillet welds in the overhead position using E6010 and E7018 electrodes.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following before performing tasks.** • Weld beads on plate in the flat position using E6010 and E7018 electrodes. • Make fillet welds in the horizontal position using E6010 and E7018 electrodes. • Make fillet welds in the vertical position using E6010 and E7018 electrodes. • Make fillet welds in the overhead position using E6010 and E7018 electrodes. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the

	student while they are performing safety inspections and operation procedures to complete a given task.
5. Identify quality welds and make various advanced welds in different positions. a. Identify and explain weld imperfections and their causes. b. Identify and explain non-destructive examination practices. c. Identify and explain welder qualification tests. d. Explain the importance of quality workmanship. e. Weld plate, V-butt with backing, using E7018 electrodes in the flat position. f. Weld beads on plate using E7018 electrodes in the horizontal position. g. Weld plate, V-butt with backing, using E7018 electrodes in the horizontal position. h. Weld beads on plate using E7018 electrodes in the vertical position. i. Weld plate, V-butt with backing, using E7018 electrodes in the vertical position. j. Weld beads on plate using E7018 electrodes in the overhead position. k. Weld plate, V-butt with backing, using E7018 electrodes in the overhead position.	**Teaching:** **The instructor will explain and demonstrate the following. The students will demonstrate the following before performing a task.** • Identify and explain weld imperfections and their causes. • Identify and explain non-destructive examination practices. • Identify and explain welder qualification tests. • Explain the importance of quality workmanship. • Weld plate, V-butt with backing, using E7018 electrodes in the flat position. • Weld beads on plate using E7018 electrodes in the horizontal position. • Weld plate, V-butt with backing, using E7018 electrodes in the horizontal position. • Weld beads on plate using E7018 electrodes in the vertical position. • Weld plate, V-butt with backing, using E7018 electrodes in the vertical position. • Weld beads on plate using E7018 electrodes in the overhead position. • Weld plate, V-butt with backing, using E7018 electrodes in the overhead position. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and operation procedures to complete a given task.
6. Weld various plates using various electrodes in different positions. a. Weld plate, open V-butt-joint, using E6010 electrodes in the flat position. b. Weld beads on plate using E6010 electrodes in the horizontal position. c. Weld plate, open V-butt-joint, using E6010 electrodes in the horizontal position.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following before performing tasks.** • Weld plate, open V-butt-joint, using E6010 electrodes in the flat position. • Weld beads on plate using E6010 electrodes in the horizontal position.

d. Weld beads on plate using E6010 electrodes in the vertical position. e. Weld plate, open V-butt-joint, using E6010 electrodes in the vertical position. f. Weld beads on plate using E6010 electrodes in the overhead position. g. Weld plate, open V-butt-joint, using E6010 electrodes in the overhead position.	• Weld plate, open V-butt-joint, using E6010 electrodes in the horizontal position. • Weld beads on plate using E6010 electrodes in the vertical position. • Weld plate, open V-butt-joint, using E6010 electrodes in the vertical position. • Weld beads on plate using E6010 electrodes in the overhead position. • Weld plate, open V-butt-joint, using E6010 electrodes in the overhead position. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and operation procedures to complete a given task.

STANDARDS

Contren Learning Series Best Practices

SAF1 Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2 Explain the role that safety plays in the construction crafts.
SAF3 Describe what job-site safety means.
SAF4 Explain the appropriate safety precautions around common job-site hazards.
SAF5 Demonstrate the use and care of appropriate personal protective equipment.
SAF5 Follow safe procedures for lifting heavy objects.
SAF6 Describe safe behavior on and around ladders and scaffolds.
SAF7 Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8 Describe fire prevention and fire fighting techniques.
SAF9 Define safe work procedures around electrical hazards.
MAT1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2 Use a standard ruler and a metric ruler to measure.
MAT3 Add, subtract, multiply, and divide fractions.
MAT4 Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5 Convert decimals to percents and percents to decimals.
MAT6 Convert fractions to decimals and decimals to fractions.
MAT7 Explain what the metric system is and how it is important in the construction trade.
MAT8 Recognize and use metric units of length, weight, volume, and temperature.
MAT9 Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1 Recognize and identify some of the basic hand tools used in the construction trade.
HTO2 Use these tools safely.

HTO3 Describe the basic procedures for taking care of these tools.
PTO1 Identify commonly used power tools of the construction trade.
PTO2 Use power tools safely.
PTO3 Explain how to maintain power tools properly.
BLU1 Recognize and identify basic blueprint terms, components, and symbols.
BLU2 Relate information on blueprints to actual locations on the print.
BLU3 Recognize different classifications of drawings.
BLU4 Interpret and use drawing dimensions.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

CUTTING AND FITTING GASKETS

MCF1 Identify and explain gasket types.
MCF2 Identify and explain gasket materials.
MCF3 Lay out and cut gaskets.
MCF4 Install gaskets.

OXY-FUEL CUTTING

MOC1 Explain oxy-fuel cutting safety.
MOC2 Identify and explain oxy-fuel cutting equipment.
MOC3 Identify and explain oxy-fuel flames.
MOC4 Identify and explain backfire and flashbacks.
MOC5 Set up oxy-fuel equipment.

MOC6 Light and adjust an oxy-fuel torch.
MOC7 Shut down oxy-fuel cutting equipment.
MOC8 Disassemble oxy-fuel equipment.
MOC9 Change empty cylinders.
MOC10 Perform housekeeping tasks.
MOC11 Perform oxy-fuel cutting:
- Straight-line and square shapes
- Piercing and slot cutting
- Bevels
- Washing
- Gouging

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Check, A., Krar, S., & Rapisarda, M. (1998). *Machine tool and manufacturing technology.* Albany, NY: Delmar.

Jeffus, L. (1999). *Welding principles and applications.* Albany, NY: Delmar.

National Center for Construction Education and Research. (2001). *Welding level I.* Upper Saddle River, NJ: Pearson Prentice Hall.

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Taylor, D. (1996). *Elementary blueprint reading for machinists* (4th ed.). Albany, NY: Delmar.

Walker, J. (2000). *Modern metalworking.* Tinley Park, IL: Goodheart-Willcox.

Metal Trades II (Advanced Welding Option)
Unit A4: Gas Metal Arc Welding (GMAW) & Flux Core Arc Welding (FCAW) (30 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Demonstrate and discuss safety procedures, applications, and the advantages and limitations, and identify the machine controls for GMAW and FCAW.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • Questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Perform various welds according to specifications. a. Perform GMAW welds (in the flat position) (1) Fabricate a butt-joint weld. (2) Fabricate a lap-joint fillet weld. (3) Fabricate a T-joint fillet weld. (4) Fabricate a V-groove butt-joint weld in the flat and horizontal positions (vertical and overhead optional) according to	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following before performing tasks.** Perform GMAW welds (in the flat position) • Fabricate a butt-joint weld. • Fabricate a lap-joint fillet weld. • Fabricate a T-joint fillet weld. • Fabricate a V-groove butt-joint weld in the flat and horizontal positions (vertical and

specifications. b. FCAW Welds (1) Fabricate a multi-pass fillet weld (vertical and overhead optional) according to specifications. (2) Fabricate a V-grooved butt-joint weld in the flat and horizontal positions (vertical and overhead optional) according to specifications.	overhead optional) according to specifications. FCAW perform welds. • Fabricate a multi-pass fillet weld (vertical and overhead optional) according to specifications. • Fabricate a V-grooved butt-joint weld in the flat and horizontal positions (vertical and overhead optional) according to specifications. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and operation procedures to complete a given task.

STANDARDS

Contren Learning Series Best Practices

SAF1 Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2 Explain the role that safety plays in the construction crafts.
SAF3 Describe what job-site safety means.
SAF4 Explain the appropriate safety precautions around common job-site hazards.
SAF5 Demonstrate the use and care of appropriate personal protective equipment.
SAF5 Follow safe procedures for lifting heavy objects.
SAF6 Describe safe behavior on and around ladders and scaffolds.
SAF7 Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8 Describe fire prevention and fire fighting techniques.
SAF9 Define safe work procedures around electrical hazards.
MAT1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2 Use a standard ruler and a metric ruler to measure.
MAT3 Add, subtract, multiply, and divide fractions.
MAT4 Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5 Convert decimals to percents and percents to decimals.
MAT6 Convert fractions to decimals and decimals to fractions.
MAT7 Explain what the metric system is and how it is important in the construction trade.
MAT8 Recognize and use metric units of length, weight, volume, and temperature.
MAT9 Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1 Recognize and identify some of the basic hand tools used in the construction trade.

HTO2 Use these tools safely.
HTO3 Describe the basic procedures for taking care of these tools.
PTO1 Identify commonly used power tools of the construction trade.
PTO2 Use power tools safely.
PTO3 Explain how to maintain power tools properly.
BLU1 Recognize and identify basic blueprint terms, components, and symbols.
BLU2 Relate information on blueprints to actual locations on the print.
BLU3 Recognize different classifications of drawings.
BLU4 Interpret and use drawing dimensions.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

FASTENERS

MFF1 Identify and explain threaded fasteners.
MFF2 Identify and explain nonthreaded fasteners.
MFF3 Identify and explain insulation fasteners.
MFF4 Install fasteners.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

OXY-FUEL CUTTING

MOC1 Explain oxy-fuel cutting safety.
MOC2 Identify and explain oxy-fuel cutting equipment.
MOC3 Identify and explain oxy-fuel flames.
MOC4 Identify and explain backfire and flashbacks.

MOC5 Set up oxy-fuel equipment.
MOC6 Light and adjust an oxy-fuel torch.
MOC7 Shut down oxy-fuel cutting equipment.
MOC8 Disassemble oxy-fuel equipment.
MOC9 Change empty cylinders.
MOC10 Perform housekeeping tasks.
MOC11 Perform oxy-fuel cutting:
- Straight-line and square shapes
- Piercing and slot cutting
- Bevels
- Washing
- Gouging

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

Check, A., Krar, S., & Rapisarda, M. (1998). *Machine tool and manufacturing technology.* Albany, NY: Delmar.

Jeffus, L. (1999). *Welding principles and applications.* Albany, NY: Delmar.

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National Center for Construction Education and Research. (2001). *Welding level II.* Upper Saddle River, NJ: Pearson Prentice Hall.

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Taylor, D. (1996). *Elementary blueprint reading for machinists* (4th ed.). Albany, NY: Delmar.

Walker, J. (2000). *Modern metalworking.* Tinley Park, IL: Goodheart-Willcox.

Metal Trades II (Advanced Welding Option)
Unit A5: Introduction to Gas Tungsten Arc Welding (GTAW) (31 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Identify proper safety procedures, principles, and parts; and perform a setup. a. Describe the different types of tungsten electrodes. b. Identify the major controls on a machine. c. Identify the parts of a torch and the functions of each. d. Identify the different types of cups and the application of each.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video.[E1] • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns.[E1, E2, E3, E5, E8, E9, E10] • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task.[E4, E3, E5] • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Perform various welds. a. Run stringer beads in the flat and horizontal positions. b. Fabricate a square groove butt-weld in the flat and horizontal positions. c. Fabricate a T-joint fillet weld in the flat and horizontal positions.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following before performing tasks.** • Run stringer beads in the flat and horizontal positions. • Fabricate a square groove butt-weld in the flat and horizontal positions. • Fabricate a T-joint fillet weld in the flat and horizontal positions.

	Assessment: • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and operation procedures to complete a given task.

STANDARDS

Contren Learning Series Best Practices

SAF1	Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2	Explain the role that safety plays in the construction crafts.
SAF3	Describe what job-site safety means.
SAF4	Explain the appropriate safety precautions around common job-site hazards.
SAF5	Demonstrate the use and care of appropriate personal protective equipment.
SAF5	Follow safe procedures for lifting heavy objects.
SAF6	Describe safe behavior on and around ladders and scaffolds.
SAF7	Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8	Describe fire prevention and fire fighting techniques.
SAF9	Define safe work procedures around electrical hazards.
MAT1	Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2	Use a standard ruler and a metric ruler to measure.
MAT3	Add, subtract, multiply, and divide fractions.
MAT4	Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5	Convert decimals to percents and percents to decimals.
MAT6	Convert fractions to decimals and decimals to fractions.
MAT7	Explain what the metric system is and how it is important in the construction trade.
MAT8	Recognize and use metric units of length, weight, volume, and temperature.
MAT9	Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1	Recognize and identify some of the basic hand tools used in the construction trade.
HTO2	Use these tools safely.
HTO3	Describe the basic procedures for taking care of these tools.
PTO1	Identify commonly used power tools of the construction trade.
PTO2	Use power tools safely.
PTO3	Explain how to maintain power tools properly.
BLU1	Recognize and identify basic blueprint terms, components, and symbols.
BLU2	Relate information on blueprints to actual locations on the print.
BLU3	Recognize different classifications of drawings.
BLU4	Interpret and use drawing dimensions.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

OXY-FUEL CUTTING

MOC1 Explain oxy-fuel cutting safety.
MOC2 Identify and explain oxy-fuel cutting equipment.
MOC3 Identify and explain oxy-fuel flames.
MOC4 Identify and explain backfire and flashbacks.
MOC5 Set up oxy-fuel equipment.
MOC6 Light and adjust an oxy-fuel torch.
MOC7 Shut down oxy-fuel cutting equipment.
MOC8 Disassemble oxy-fuel equipment.
MOC9 Change empty cylinders.
MOC10 Perform housekeeping tasks.
MOC11 Perform oxy-fuel cutting:
- Straight-line and square shapes
- Piercing and slot cutting
- Bevels
- Washing
- Gouging

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

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Metal Trades II
Unit A6: Plasma Arc Cutting (PAC) (8 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Explain safety and identify the major components.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Set up and perform operations using the plasma arc cutting process. a. Perform necessary setup. b. Cut mild steel.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following before performing tasks.** • Perform necessary setup. • Cut mild steel. **Assessment:** • A written test will be given for the terminology.

	• A checklist will be used to observe the student while they are performing safety inspections and operation procedures to complete a given task.

STANDARDS

Contren Learning Series Best Practices

SAF1 Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2 Explain the role that safety plays in the construction crafts.
SAF3 Describe what job-site safety means.
SAF4 Explain the appropriate safety precautions around common job-site hazards.
SAF5 Demonstrate the use and care of appropriate personal protective equipment.
SAF5 Follow safe procedures for lifting heavy objects.
SAF6 Describe safe behavior on and around ladders and scaffolds.
SAF7 Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8 Describe fire prevention and fire fighting techniques.
SAF9 Define safe work procedures around electrical hazards.
MAT1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2 Use a standard ruler and a metric ruler to measure.
MAT3 Add, subtract, multiply, and divide fractions.
MAT4 Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5 Convert decimals to percents and percents to decimals.
MAT6 Convert fractions to decimals and decimals to fractions.
MAT7 Explain what the metric system is and how it is important in the construction trade.
MAT8 Recognize and use metric units of length, weight, volume, and temperature.
MAT9 Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1 Recognize and identify some of the basic hand tools used in the construction trade.
HTO2 Use these tools safely.
HTO3 Describe the basic procedures for taking care of these tools.
PTO1 Identify commonly used power tools of the construction trade.
PTO2 Use power tools safely.
PTO3 Explain how to maintain power tools properly.
BLU1 Recognize and identify basic blueprint terms, components, and symbols.
BLU2 Relate information on blueprints to actual locations on the print.
BLU3 Recognize different classifications of drawings.
BLU4 Interpret and use drawing dimensions.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

CUTTING AND FITTING GASKETS

MCF1 Identify and explain gasket types.
MCF2 Identify and explain gasket materials.
MCF3 Lay out and cut gaskets.
MCF4 Install gaskets.

OXY-FUEL CUTTING

MOC1 Explain oxy-fuel cutting safety.
MOC2 Identify and explain oxy-fuel cutting equipment.
MOC3 Identify and explain oxy-fuel flames.
MOC4 Identify and explain backfire and flashbacks.
MOC5 Set up oxy-fuel equipment.
MOC6 Light and adjust an oxy-fuel torch.
MOC7 Shut down oxy-fuel cutting equipment.
MOC8 Disassemble oxy-fuel equipment.
MOC9 Change empty cylinders.
MOC10 Perform housekeeping tasks.
MOC11 Perform oxy-fuel cutting:
- Straight-line and square shapes
- Piercing and slot cutting
- Bevels
- Washing
- Gouging

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
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E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
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Workplace Skills for the 21st Century

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

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Metal Trades II (Advanced Machine Shop Option)
Unit B1: Orientation, Advanced Leadership, and Employability Skills (10 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe local program and vocational center policies and procedures. a. Describe local program and vocational center policies and procedures including dress code, attendance, academic requirements, discipline, and transportation regulations.	**Teaching:** • Present local program and vocational center policies and procedures. • Students will read the handbook to become aware of what is expected of them in relation to the policies and procedures of the school. This will include dress code, attendance, academic requirements, discipline, and transportation regulations. Students will work together in pairs. A student with a higher reading ability will team up with a student with a lower reading ability to get a better understanding of the school's program policies and procedures.[E2, E3, E8] **Assessment:** • Students will have a test on applicable policies and procedures. • Students will submit a written report on rules and regulations. • Explanation of local student handbook requirements. • Students will complete exercises to identify equipment and functions found in the school lab. • Assess student orientation knowledge through instructor observations and written unit test. File completed test to document student mastery of the school and program policies and procedures.
2. Describe employment opportunities and responsibilities. a. Describe employment opportunities including potential earnings, employee benefits, job availability, place of employment, working conditions, and educational requirements. b. Describe basic employee responsibilities. c. Design a resume and complete a job application.	**Teaching:** • Use the Contren Series Core Text, Basic Employability Skills Unit and Welding Level I, Orientation to the Trade Unit to define trade terms related to basic employability skills. Discuss the chapter and perform the related activities to promote awareness of employability skills.[E2] • The instructor will explain the contents of a cover letter and resume. Examples of cover

	letters and resumes will be given to the students. The student will design a cover letter and resume. • The instructor will discuss a job application. The student will obtain and complete a job application from a local business. • Students will use career software, such as Choices, to measure their aptitudes and abilities for particular careers.[E3, E8] • Students will use the Internet to research a list of careers for which they will be qualified upon program completion.[E2, E3, E4, E5, E10] • Students will use available resources (college catalogs and college websites) to research information about postsecondary educational opportunities.[E2, E3, E4, E5, E10] • Students will select a career in the field and outline educational and skill requirements, expected job growth, and entry-level salaries.[E1, E3, E8, E9] **Assessment:** • Assessment will be determined by matching test for definitions and the level of success regarding the Contren activities. Lessons involving writing and math skills will be integrated with the appropriate department. • Use a checklist to evaluate the campaign speech and poster. • Use a checklist to evaluate the resume and cover letter. • A rubric will be used to evaluate the job application. • Use a checklist to evaluate the presentation. • Review career software printout to assess student aptitudes and abilities.
3. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA. a. Demonstrate effective teambuilding and leadership skills. b. Practice appropriate work ethics.	**Teaching:** • Discuss the role of a team member and leader. Assign the students roles within a team and have them role play a situation in which there is a conflict which must be resolved. Utilize the lessons from SkillsUSA, Contren Tools for Success, or

	other resources to provide additional training.[E3, E8] • Discuss appropriate work ethics standards. Have the students list what they believe to be the most common problems within the metal trades professions. **Assessment:** • Assess the role play using a checklist for documentation. • Lessons from other resources should be assessed according to the recommended resource guide.
4. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations.	**Teaching:** • Have the students perform an activity involving verbal instructions. Divide the students into groups and have one team be the customer and the other be the contractor. The customer will describe the project and the contractor will have to provide a brief plan for the construction of the project. Have the groups switch roles and the customer will provide the contractor with a written plan and blueprint. The contractor will describe the procedure for construction of the project.[E2, E3, E4, E8] **Assessment:** • The lesson will be assessed using a rubric and a checklist for the written projects.

STANDARDS

Contren Learning Series Best Practices

SAF1 Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2 Explain the role that safety plays in the construction crafts.
SAF3 Describe what job-site safety means.
SAF4 Explain the appropriate safety precautions around common job-site hazards.
SAF5 Demonstrate the use and care of appropriate personal protective equipment.
SAF5 Follow safe procedures for lifting heavy objects.
SAF6 Describe safe behavior on and around ladders and scaffolds.
SAF7 Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8 Describe fire prevention and fire fighting techniques.

SAF9 Define safe work procedures around electrical hazards.
MAT1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2 Use a standard ruler and a metric ruler to measure.
MAT3 Add, subtract, multiply, and divide fractions.
MAT4 Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5 Convert decimals to percents and percents to decimals.
MAT6 Convert fractions to decimals and decimals to fractions.
MAT7 Explain what the metric system is and how it is important in the construction trade.
MAT8 Recognize and use metric units of length, weight, volume, and temperature.
MAT9 Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1 Recognize and identify some of the basic hand tools used in the construction trade.
HTO2 Use these tools safely.
HTO3 Describe the basic procedures for taking care of these tools.
PTO1 Identify commonly used power tools of the construction trade.
PTO2 Use power tools safely.
PTO3 Explain how to maintain power tools properly.
BLU1 Recognize and identify basic blueprint terms, components, and symbols.
BLU2 Relate information on blueprints to actual locations on the print.
BLU3 Recognize different classifications of drawings.
BLU4 Interpret and use drawing dimensions.
RIG1 Identify and describe the use of slings and common rigging hardware.
RIG2 Describe the basic inspection techniques and rejection criteria used for slings and hardware.
RIG3 Describe the basic hitch configurations and their proper connections.
RIG4 Describe basic load-handling safety practices.
RIG5 Demonstrate proper use of American National Standards Institute (ANSI) hand signals.
COM1 Demonstrate the ability to understand information and instructions that are presented in both written and verbal form.
COM2 Demonstrate the ability to communicate effectively in on-the-job situations using written and verbal skills.
EMP1 Explain the construction industry, the role of the companies that make up the industry, and the role of individual professionals in the industry.
EMP2 Demonstrate critical thinking skills and the ability to solve problems using those skills.
EMP3 Demonstrate knowledge of computer systems and explain common uses for computers in the construction industry.
EMP4 Demonstrate effective relationship skills with teammates and supervisors, exhibit the ability to work on a team, and demonstrate appropriate leadership skills.
EMP5 Be aware of workplace issues such as sexual harassment, stress, and substance abuse.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

FASTENERS

MFF1 Identify and explain threaded fasteners.
MFF2 Identify and explain nonthreaded fasteners.
MFF3 Identify and explain insulation fasteners.
MFF4 Install fasteners.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
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MBL6 Scribe perpendicular lines to an edge, using a combination square.
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MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
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MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

CUTTING AND FITTING GASKETS

MCF1 Identify and explain gasket types.
MCF2 Identify and explain gasket materials.
MCF3 Lay out and cut gaskets.
MCF4 Install gaskets.

OXY-FUEL CUTTING

MOC1 Explain oxy-fuel cutting safety.
MOC2 Identify and explain oxy-fuel cutting equipment.
MOC3 Identify and explain oxy-fuel flames.
MOC4 Identify and explain backfire and flashbacks.
MOC5 Set up oxy-fuel equipment.
MOC6 Light and adjust an oxy-fuel torch.
MOC7 Shut down oxy-fuel cutting equipment.
MOC8 Disassemble oxy-fuel equipment.
MOC9 Change empty cylinders.
MOC10 Perform housekeeping tasks.
MOC11 Perform oxy-fuel cutting:
- Straight-line and square shapes

- Piercing and slot cutting
- Bevels
- Washing
- Gouging

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
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Workplace Skills for the 21st Century

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
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Metal Trades II (Advanced Machine Shop Option)
Unit B2: Basic Safety **(8 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe general safety rules for working in a shop/lab and industry. a. Describe how to avoid on-site accidents. b. Explain the relationship between housekeeping and safety. c. Explain the importance of following all safety rules and company safety policies. d. Explain the importance of reporting all on-the-job injuries and accidents. e. Explain the need for evacuation policies and the importance of following them. f. Explain the employer's substances abuse policy and how it relates to safety. g. Explain the safety procedures when working near pressurized or high temperature.	**Teaching:** **This can be used for the entire unit.** • Identify, discuss, and demonstrate terms, rules, and procedures related to shop/lab and industry safety.[E3, E8] • Required written tests will follow each section of guidelines for safety rules and procedures. • Provide the students with a list of terms and have them define the terms. Pair the students to quiz each other on the definitions in preparation for a written exam.[E2, E3, E4, E8] • Use the guidelines provided for personal safety (i.e., clothing, jewelry, hair, eyes, and ears). Divide the students into pairs and assign one of the guidelines. Each pair will demonstrate the "do's and don'ts" of the assigned guideline. • Have an industry speaker present to the class the necessity of safety in the work environment. The students will write a summary of the presentation.[E1, E2, E9] • Divide the students into teams and have them develop scenarios of hazards and accidents using the publications and the Internet. This will include tools, spills, working around welding, ladders or scaffolds, use of MSDS information, fires, and electrical situations. In a game type situation, one team will read a scenario and the other teams will compete to be the first to provide the proper safety measures which should have been used to prevent the hazardous situation. Points will be awarded to the teams with the correct answers.[E2, E4] • Required written tests will follow each section of guidelines for safety rules and procedures. • NOTE: SAFETY IS TO BE TAUGHT AS AN ONGOING PART OF THE COURSE THROUGHOUT THE YEAR.
2. Identify and apply safety around metal trades operations. a. Use proper safety practices when performing metal trades operations. b. Recognize and explain personal protective equipment. c. Inspect and care for personal protective equipment.	
3. Explain lifting. a. Identify and explain the procedures for lifting heavy objects.	
4. Explain the Material Safety Data Sheet (MSDS). a. Explain the function of the MSDS. b. Interpret the requirements of the MSDS.	
5. Explain fires. a. Explain the process by which fires start. b. Explain fire prevention of various flammable liquids.	

c. Explain the classes of fire and the types of extinguishers. 6. Explain safety in and around metal trades and electrical situations. a. Explain injuries when electrical contact occurs. b. Explain safety around metal trades and electrical hazards. c. Explain action to take when an electrical shock occurs.	**Assessment:** • Student participation will be monitored by the instructor and the written exam will be graded. The student must achieve 100 % accuracy. • The "do's and don'ts" exercise will be critiqued with a peer review. • The summary of the speaker's presentation will be critiqued using a rubric. • The teams will be rewarded according the points earned from the game. This could be extra points, classroom privileges, etc. • Written exams will be graded.

STANDARDS

Contren Learning Series Best Practices

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SAF5 Demonstrate the use and care of appropriate personal protective equipment.
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HTO2 Use these tools safely.
HTO3 Describe the basic procedures for taking care of these tools.
PTO1 Identify commonly used power tools of the construction trade.
PTO2 Use power tools safely.
PTO3 Explain how to maintain power tools properly.
BLU1 Recognize and identify basic blueprint terms, components, and symbols.

BLU2 Relate information on blueprints to actual locations on the print.
BLU3 Recognize different classifications of drawings.
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RIG1 Identify and describe the use of slings and common rigging hardware.
RIG2 Describe the basic inspection techniques and rejection criteria used for slings and hardware.
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MILLWRIGHT HAND TOOLS

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MHT2 Use and care for millwright hand tools.

FASTENERS

MFF1 Identify and explain threaded fasteners.
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MFF3 Identify and explain insulation fasteners.
MFF4 Install fasteners.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.

MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

CUTTING AND FITTING GASKETS

MCF1 Identify and explain gasket types.
MCF2 Identify and explain gasket materials.
MCF3 Lay out and cut gaskets.
MCF4 Install gaskets.

OXY-FUEL CUTTING

MOC1 Explain oxy-fuel cutting safety.
MOC2 Identify and explain oxy-fuel cutting equipment.
MOC3 Identify and explain oxy-fuel flames.
MOC4 Identify and explain backfire and flashbacks.
MOC5 Set up oxy-fuel equipment.
MOC6 Light and adjust an oxy-fuel torch.
MOC7 Shut down oxy-fuel cutting equipment.
MOC8 Disassemble oxy-fuel equipment.
MOC9 Change empty cylinders.
MOC10 Perform housekeeping tasks.
MOC11 Perform oxy-fuel cutting:
- Straight-line and square shapes
- Piercing and slot cutting
- Bevels
- Washing
- Gouging

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.

E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

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National Center for Construction Education and Research. (2001). *Welding level I.* Upper Saddle River, NJ: Pearson Prentice Hall.

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Taylor, D. (1996). *Elementary blueprint reading for machinists* (4th ed.). Albany, NY: Delmar.

Walker, J. (2000). *Modern metalworking.* Tinley Park, IL: Goodheart-Willcox.

Metal Trades II (Advanced Machine Shop Option)
Unit B3: Lathe Operations (105 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe safety precautions, methods for measuring thread pitch diameters, and calculation of dimensions using taper formulas. a. Describe safety precautions. b. Describe methods for measuring thread pitch diameters. c. Calculate dimensions using taper formulas.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Perform various operations according to specifications. a. Perform chamfer, recessing, knurling, drill and recess a hole, align and start a tap using a lathe center, and cutoff. b. Perform turning a taper with taper attachment, turning a taper with compound, boring, cutting external threads to relief, pick up threads, and cutting internal threads.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following before performing tasks.** • Perform chamfer, recessing, knurling, drill and recess a hole, align and start a tap using a lathe center, and cutoff. • Perform turning a taper with taper attachment, turning a taper with compound, boring, cutting external threads to relief,

	pick up threads, and cutting internal threads. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and operation procedures to complete a given task.

STANDARDS

Contren Learning Series Best Practices

SAF1	Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2	Explain the role that safety plays in the construction crafts.
SAF3	Describe what job-site safety means.
SAF4	Explain the appropriate safety precautions around common job-site hazards.
SAF5	Demonstrate the use and care of appropriate personal protective equipment.
SAF5	Follow safe procedures for lifting heavy objects.
SAF6	Describe safe behavior on and around ladders and scaffolds.
SAF7	Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8	Describe fire prevention and fire fighting techniques.
SAF9	Define safe work procedures around electrical hazards.
MAT1	Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2	Use a standard ruler and a metric ruler to measure.
MAT3	Add, subtract, multiply, and divide fractions.
MAT4	Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5	Convert decimals to percents and percents to decimals.
MAT6	Convert fractions to decimals and decimals to fractions.
MAT7	Explain what the metric system is and how it is important in the construction trade.
MAT8	Recognize and use metric units of length, weight, volume, and temperature.
MAT9	Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1	Recognize and identify some of the basic hand tools used in the construction trade.
HTO2	Use these tools safely.
HTO3	Describe the basic procedures for taking care of these tools.
PTO1	Identify commonly used power tools of the construction trade.
PTO2	Use power tools safely.
PTO3	Explain how to maintain power tools properly.
BLU1	Recognize and identify basic blueprint terms, components, and symbols.
BLU2	Relate information on blueprints to actual locations on the print.
BLU3	Recognize different classifications of drawings.
BLU4	Interpret and use drawing dimensions.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
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E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.

WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

T1 Basic operations and concepts
T4 Technology communications tools
T5 Technology research tools
T6 Technology problem-solving and decision-making tools

Suggested References

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Jeffus, L. (1999). *Welding principles and applications.* Albany, NY: Delmar.

Taylor, D. (1996). *Elementary blueprint reading for machinists* (4th ed.). Albany, NY: Delmar.

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Metal Trades II (Advanced Machine Shop Option)
Unit B4: Milling Operations **(52 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Explore horizontal and vertical milling operations. a. Describe and apply safety rules. b. Identify the types of milling machines and describe the major components. c. Identify work-holding devices, cutting tools, tool holders, and other attachments. d. Describe the different types of horizontal milling operations.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Adjust speed and feed rates, clean and lubricate, mount arbors and adjust arbor support bushing, mount a cutter, mill a key-way, and perform selected horizontal operations. a. Adjust machine speed and feed rates; clean and lubricate. b. Mount arbors and adjust arbor support bushing and mount a cutter according to specifications. c. Perform selected operations according	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following before performing tasks.** • Adjust machine speed and feed rates; clean and lubricate. • Mount arbors and adjust arbor support bushing and mount a cutter according to specifications. • Perform selected operations according to

to specifications.	specifications. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and operation procedures to complete a given task.
3. Mount and remove cutters and cutter holders, align a vise using a dial indicator, and perform selected vertical milling and boring operations. a. Mount and remove cutters and cutter holders; mount and align a vise. b. Perform selected milling and boring operations according to specifications.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following before performing tasks.** • Mount and remove cutters and cutter holders; mount and align a vise. • Perform selected milling and boring operations according to specifications. **Assessment:** • A written test will be given for the terminology. • A checklist will be used to observe the students while they are performing safety inspections and operation procedures to complete a given task.

STANDARDS

Contren Learning Series Best Practices

SAF1 Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2 Explain the role that safety plays in the construction crafts.
SAF3 Describe what job-site safety means.
SAF4 Explain the appropriate safety precautions around common job-site hazards.
SAF5 Demonstrate the use and care of appropriate personal protective equipment.
SAF5 Follow safe procedures for lifting heavy objects.
SAF6 Describe safe behavior on and around ladders and scaffolds.
SAF7 Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8 Describe fire prevention and fire fighting techniques.
SAF9 Define safe work procedures around electrical hazards.
MAT1 Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2 Use a standard ruler and a metric ruler to measure.
MAT3 Add, subtract, multiply, and divide fractions.
MAT4 Add, subtract, multiply, and divide decimals, with and without a calculator.

MAT5 Convert decimals to percents and percents to decimals.
MAT6 Convert fractions to decimals and decimals to fractions.
MAT7 Explain what the metric system is and how it is important in the construction trade.
MAT8 Recognize and use metric units of length, weight, volume, and temperature.
MAT9 Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1 Recognize and identify some of the basic hand tools used in the construction trade.
HTO2 Use these tools safely.
HTO3 Describe the basic procedures for taking care of these tools.
PTO1 Identify commonly used power tools of the construction trade.
PTO2 Use power tools safely.
PTO3 Explain how to maintain power tools properly.
BLU1 Recognize and identify basic blueprint terms, components, and symbols.
BLU2 Relate information on blueprints to actual locations on the print.
BLU3 Recognize different classifications of drawings.
BLU4 Interpret and use drawing dimensions.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

Academic Standards

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
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National Educational Technology Standards for Students

T1 Basic operations and concepts
T4 Technology communications tools
T5 Technology research tools
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Metal Trades II (Advanced Machine Shop Option)
Unit B5: Grinding Operations **(23 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Describe safety, magnetic chuck work, surface grinding operations, and reasons for truing and balancing a grinding wheel. a. Describe grinding safety. b. Describe safety rules that apply to magnetic chuck work. c. Identify surface grinding operations. d. Explain reasons for truing and balancing grinding wheels.	**Teaching:** **Note: These strategies can be used for the entire unit. Safety will be reviewed and reinforced before and during the unit.** • The instructor will present a video on the given task. The student will develop several questions and answers from the video. E1 • The instructor will demonstrate identification and interpretation of the specific task concerns. The student will utilize a variety of resources to write a report to identify and interpret task concerns. E1, E2, E3, E5, E8, E9, E10 • Divide the students into groups and assign each group a specific task. Have each group construct a poster listing components and the diagram of the task. E4, E3, E5 • Actual pictures from the lab will be shown and discussed about the specific task. The students will perform each task assigned. **Assessment:** • The questions and answers will be evaluated for content and clarity. • A report will be presented to the class. A rubric will be used to evaluate the presentation. • Evaluate the poster for content and clarity. • A checklist will be used to evaluate the task.
2. Perform maintenance operations to manufacturer's specifications and grinding operations to teacher's specifications. a. Remove and replace a grinding wheel. b. Dress a wheel flat. c. Grind a work piece flat and parallel. Grind a work piece square, an angular surface, and to dimension.	**Teaching:** **The instructor will explain and demonstrate the following tasks. The students will demonstrate the following before performing tasks.** • Remove and replace a grinding wheel. • Dress a wheel flat. • Grind a work piece flat and parallel. Grind a work piece square, an angular surface, and to dimension.

	Assessment: • A written test will be given for the terminology. • A checklist will be used to observe the student while they are performing safety inspections and operation procedures to complete a given task.

STANDARDS

Contren Learning Series Best Practices

SAF1	Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2	Explain the role that safety plays in the construction crafts.
SAF3	Describe what job-site safety means.
SAF4	Explain the appropriate safety precautions around common job-site hazards.
SAF5	Demonstrate the use and care of appropriate personal protective equipment.
SAF5	Follow safe procedures for lifting heavy objects.
SAF6	Describe safe behavior on and around ladders and scaffolds.
SAF7	Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8	Describe fire prevention and fire fighting techniques.
SAF9	Define safe work procedures around electrical hazards.
MAT1	Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2	Use a standard ruler and a metric ruler to measure.
MAT3	Add, subtract, multiply, and divide fractions.
MAT4	Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5	Convert decimals to percents and percents to decimals.
MAT6	Convert fractions to decimals and decimals to fractions.
MAT7	Explain what the metric system is and how it is important in the construction trade.
MAT8	Recognize and use metric units of length, weight, volume, and temperature.
MAT9	Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1	Recognize and identify some of the basic hand tools used in the construction trade.
HTO2	Use these tools safely.
HTO3	Describe the basic procedures for taking care of these tools.
PTO1	Identify commonly used power tools of the construction trade.
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PTO3	Explain how to maintain power tools properly.
BLU1	Recognize and identify basic blueprint terms, components, and symbols.
BLU2	Relate information on blueprints to actual locations on the print.
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BASIC LAYOUT

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MBL9 Scribe circles, using dividers.
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MBL11 Scribe perpendicular lines from base lines, using dividers.
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Academic Standards

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Recommended Tools and Equipment

CAPITALIZED ITEMS

WELDING

1. Work bench with medium duty vises (4)
2. Oxy-fuel burning table with dross pan and replaceable slats (4'x8'x31") (2)
3. Exhaust system (1)
4. Guided bend testing machine (1)
5. Compressed air supply and accessories (minimum delivery 80 psi @ 8 cfm per station) (1)
6. Plasma arc cutting device with minimum 1/2 cutting depth (2)
7. Shielded metal arc welding machines (AC/DC—constant current 300 amp @ 60%) with cables and accessories (6)
8. Gas tungsten arc welding machine (AC/DC—constant current 300 amp @ 60%) with cables and accessories (1)
9. Gas metal arc welding machines (spray and short circuit) (DC—constant voltage 300 amp @ 100%) with cables, gun, and accessories (4)
10. Flux-cored arc welding machine (DC—constant voltage 300 amp @ 100%) with cables, gun, and accessories (2)
11. Oxy-fuel gas cutting equipment with regulators, hoses, torch, tips, cart, and accessories (2 sets)
12. Machine oxy-fuel gas cutting equipment with regulators, hoses, torch, tips, rails or track, and accessories (1 set)
13. Safety glasses with side shields and a sanitizing cabinet (1 set)
14. Ironworker (1)
15. Pedestal grinders (2)
16. Large drill press (1)
17. Small drill press (1)
18. Band saw (1)
19. Saw, power cutoff (1)

MACHINE SHOP

1. Boring bars set with holders: small, medium, large (1)
2. 14" lathes with accessories (6)
3. Vernier caliper, 8" (1)
4. Vertical milling machines with vises (3)
5. Height gage (1)
6. Gage blocks (1 set)
7. Horizontal milling machine with vise (1)
8. Machinist’s level (1)
9. Surface grinders (2)
10. Horizontal bandsaw (1)
11. Vertical bandsaw (1)

12. Hydraulic press, minimum 25 ton (1)
13. Dividing head with tailstock (1)
14. Rotary table for milling machine (1)
15. Sander, belt (1)
16. Reamer, tapered, set, 5/8"–1" (1)
17. Reamer set, adjustable (6)
18. Sander, disk (1)
19. Micrometers, 0"–6" (1 set)
20. Drill, taper, set 5/8"–1") (1)
21. Drill press and mill tools (2)
22. Quick change tool post holders (4)
23. Thread holder bars (4)

SHEET METAL

1. 4' box and pan brake with bar folder (1)
2. 4' shear with 16 gage capability (1)
3. Crimping machine (1)
4. Slip roll former (1)
5. Sheet metal set down tools, stake set, and table (1)

NON-CAPITALIZED ITEMS

WELDING

1. First-aid kit (1)
2. Emergency eye wash station (1)
3. 8" c-clamps (10)
4. 4 ½" right angle grinder (6)
5. 9" right angle grinder (2)
6. Work area protective screens (as required)
7. Framing squares, 24"x18" (6)
8. Compressed air hoses, 50", with retractable reel (2)
9. Compressed air regulator (1)
10. Male and female quick couples and adaptors (as required)
11. Hose repair kit with crimping tool for oxy-fuel (1)
12. Leather jacket, cape, sleeves or apron (6 sets)
13. Leather gloves (1 pair per student)
14. Burning goggles or face shields (5)
15. #5 filter plate/lens (5)
16. Clear cover plate/lens (5)
17. Welding helmets (10)
18. Welding lenses to match helmet, #10 shaded filter plate/lens (10)
19. Clear cover plate/lens (10)
20. Stainless steel wire brushes, 1 for every 2 students (10)
21. 16 ounce ball peen hammers (4)

22. Electric hand drill, 3/8" & 1/2" chuck (4)
23. Center punches (2 sets)
24. Metal scribes (12)
25. Steel dividers, radius maker, minimum 6" (12)
26. Steel tapes, minimum 10' (12)
27. Combination square sets (8)
28. English/metric steel bench rules (min. 12") (6)
29. Chipping hammers (12)
30. 10" mill files, half round-bastard cut (10)
31. Cold chisels (1 set)
32. Adjustable wrenches, 12", 10", 8", 6" (n1 set)
33. Tank wrenches (2)
34. 10" groove or slip joint pliers (8)
35. 6" side or diagonal cutting pliers (4)
36. 6" needle nose pliers (2)
37. 10" vise grips (4)
38. 10" vise grip clamps (4)
39. Allen or hex wrenches, up to 3/8″ (6 sets)
40. Screwdrivers, flat head (1 set)
41. Screwdrivers, Phillips head (1 set)
42. Oxy-fuel friction lighters, with flints and tip cleaners (4)
43. Fillet gages (4 set)
44. Welding clamps (6)
45. Clamps, C, set (4"–12") (2)

MACHINE SHOP

1. Dial caliper, 8" (4)
2. Thread micrometer, 0"–2" (1)
3. Machinist rules, 6" (12)
4. Gages, center and edge combination (6)
5. Hook rule, 6" (6)
6. Edge finder (1)
7. Hole punches (1 set)
8. Drill bits, numbers, letters, fractions (1 set)
9. Transfer punches (1 set)
10. V blocks (1 set)
11. Parallels, 1"–3/8" (1 set)
12. Tap and die, English sets, include most common sizes in taper, plug, and bottom in NC and NF (2)
13. Tap and die, metric sets, include most common sizes in taper plug and bottom (2)
14. Oil cans (8)
15. Reamer, shell, set (1)
16. Scales, 12" (6)
17. Locking grip pliers (6)
18. Wrench, pipe, set, 6", 10" & 12" (1)

19. Hammers, ball peen set, small, medium, and large (4)
20. Hammer, sledge, 10 lb (1)
21. Sets, counter (6)
22. Calipers, inside (6)
23. Calipers, outside (6)
24. Micrometers, 0"–1" (4)
25. Micrometers, digital (2)
26. Calipers, digital (2)
27. Dial indicators with magnetic base, graduated for .001", range 2" (2)
28. Depth micrometer, 0"–6" (1)
29. Angle blocks, 4", 6" (1)
30. Thread pitch gage (1)
31. Carbide tool holders:
    a) Turning (4)
    b) Threading (4)
    c) Facing (4)

SHEET METAL

1. Aviation snips, left, right, straight (3 sets)
2. Tinner's hammers (4)
3. Soft face mallet, wood, rawhide, rubber (1)
4. Rivet setter (N1)
5. Hand groove set, 3/16"–2" (1)
6. Hand seamer (1)
7. Dove tailer (1)
8. Soldering copper, flat (1)
9. Soldering copper, diamond (1)
10. Whitney punch (1)
11. Pop rivet guns (2)
12. Straight snips (2)
13. E-Z edger (1)
14. Combination snips (2)
15. Bulldog snips (2)
16. Scratch awls (6)
17. Circumference rules (4)
18. Dividers (6"–12") (1)
19. Trammel points (1 set)
20. Rivet hammers (4)

RECOMMENDED INSTRUCTIONAL AIDS

It is recommended that instructors have access to the following items:

1. Scientific calculator (1)
2. Cart, AV, for overhead projector (1)

3. Cart, AV, for TV-VCR (1)
4. Computer with operating software with multimedia kit (5)
5. Projector, overhead (1)
6. TV-VCR (1)
7. Video out, Microcomputer to TV monitor (1)
8. Video/audio data projector (1)
9. Laptop computer (1)
10. Computer file server with network software (1)
11. Digital camera (1)
12. Digital scanner with Optical Character Recognition (OCR) (1)
13. Interactive display board (1)

Student Competency Profile for Metal Trades I

Student:_____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Orientation and Leadership

_____1. Describe local program and vocational/career technical center policies and procedures.
_____2. Describe employment opportunities and responsibilities.
_____3. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA.
_____4. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on- the-job situations.
_____5. Discuss the history of metal trades industry to include materials, terminology, and techniques.

Unit 2: Basic Safety

_____1. Describe general safety rules for working in a shop/lab and industry.
_____2. Identify and apply safety around metal trades operations.
_____3. Explain lifting.
_____4. Explain the Material Safety Data Sheet (MSDS).
_____5. Explain fires.
_____6. Explain safety in and around metal trades and electrical situations.

Unit 3: Basic Math

_____1. Apply the four basic math skills with whole numbers, fractions, and percent.
_____2. Use the metric system.
_____3. Apply basic mathematics for welding.

Unit 4: Introduction to Blueprints

_____1. Read, analyze, and design a blueprint.

Unit 5: Hand and Power Tools

_____1. Demonstrate the use and maintenance of various hand and power tools.

Unit 6: Basic Rigging

_____1. Explain and identify safe rigging and equipment.
_____2. Discuss the proper use of load-handling and signaling practices.

Unit 7: Millwright

_____1. Explain and demonstrate the safe use and maintenance of millwright hand tools.
_____2. Explore millwright fasteners.
_____3. Explain and install the types of retainer rings.
_____4. Identify and describe layout and scribe procedures.

Unit 8: Power Saws and Drilling Machines

_____1. Identify and describe the safe operation of the types of power saws.
_____2. Identify and describe the types of drilling machines, including hand powered and drill press, and the rules for safe operation of each.

Unit 9: Basic Welding

_____1. Identify and describe the basic equipment, setup, and safety rules for proper use of equipment and prepare base metal for welding (SMAW and GMAW), oxy-fuel welding and brazing.
_____2. Perform various operations of welding, oxy-fuel welding, and brazing using the proper equipment.

Unit 10: Basic Machine Shop

_____1. Identify and describe safety rules that apply to the pedestal grinder, and perform inspection, maintenance, and grinding operations.
_____2. Identify and compare shapes of single-point, carbide, and high speed steel cutting tools.
_____3. Identify safety rules and components of an engine lathe.
_____4. Remove and install a lathe chuck, and perform lathe operations using carbide inserts.

Unit 11: Introduction to Sheet Metal

_____1. Identify and describe various fasteners, hangers, supports, hand tools, sheet metal machines, and terms.
_____2. Fabricate assigned sheet metal projects.

Student Competency Profile for Metal Trades II (Advanced Welding Option)

Student:_____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit A1: Orientation, Advanced Leadership, and Employability Skills

_____1. Describe local program and vocational center policies and procedures.
_____2. Describe employment opportunities and responsibilities.
_____3. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA.
_____4. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations.

Unit A2: Basic Safety

_____1. Describe general safety rules for working in a shop/lab and industry.
_____2. Identify and apply safety around welding operations.
_____3. Identify and explain use of various barriers and confinements.
_____4. Explain lifting and the use of ladders and scaffolds.
_____5. Explain the Material Safety Data Sheet (MSDS).
_____6. Explain fires.
_____7. Explain safety in and around electrical situations.

Unit A3: Shielded Metal Arc Welding (SMAW)

_____1. Identify and explain safety, setup, weld cleanup, and maintenance of arc welding equipment.
_____2. Identify and use procedures for joint fit-up and alignment.
_____3. Identify and explain filler metal and selection of electrodes.
_____4. Construct various welds using different positions and electrodes.
_____5. Identify quality welds and make various advanced welds in different positions.
_____6. Weld various plates using various electrodes in different positions.

Unit A4: Gas Metal Arc Welding (GMAW) & Flux Core Arc Welding (FCAW)

_____1. Demonstrate and discuss safety procedures, applications, and the advantages and limitations, and identify the machine controls for GMAW and FCAW.
_____2. Perform various welds according to specifications.

Unit A5: Introduction to Gas Tungsten Arc Welding (GTAW)

_____1. Identify proper safety procedures, principles, and parts; and perform a setup.
_____2. Perform various welds.

Unit A6: Plasma Arc Cutting (PAC)

_____1. Explain safety and identify the major components.
_____2. Set up and perform operations using the plasma arc cutting process.

Student Competency Profile for Metal Trades II (Advanced Machine Shop Option)

Student:_____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit B1: Orientation, Advanced Leadership, and Employability Skills

_____1. Describe local program and vocational center policies and procedures.
_____2. Describe employment opportunities and responsibilities.
_____3. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA.
_____4. Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations.

Unit B2: Basic Safety

_____1. Describe general safety rules for working in a shop/lab and industry.
_____2. Identify and apply safety around metal trades operations.
_____3. Identify and explain use of various barriers and confinements.
_____4. Explain lifting.
_____5. Explain the Material Safety Data Sheets (MSDS).
_____6. Explain fires.
_____7. Explain safety in and around metal trades and electrical situations.

Unit B3: Lathe Operations

_____1. Describe safety precautions, methods for measuring thread pitch diameters, and calculation of dimensions using taper formulas.
_____2. Perform various operations according to specifications.

Unit B4: Milling Operations

_____1. Explore horizontal and vertical milling operations.
_____2. Adjust speed and feed rates, clean and lubricate, mount arbors and adjust arbor support bushing, mount a cutter, mill a key-way, and perform selected horizontal operations.

_____3. Mount and remove cutters and cutter holders, align a vise using a dial indicator, and perform selected vertical milling and boring operations.

Unit B5: Grinding Operations

_____1. Describe safety, magnetic chuck work, surface grinding operations, and reasons for truing and balancing a grinding wheel.
_____2. Perform maintenance operations to manufacturer's specifications and grinding operations to teacher's specifications.

Appendix A: Contren Learning Series Best Practices [1]

SAF1	Identify the responsibilities and personal characteristics of a professional craftsperson.
SAF2	Explain the role that safety plays in the construction crafts.
SAF3	Describe what job-site safety means.
SAF4	Explain the appropriate safety precautions around common job-site hazards.
SAF5	Demonstrate the use and care of appropriate personal protective equipment.
SAF5	Follow safe procedures for lifting heavy objects.
SAF6	Describe safe behavior on and around ladders and scaffolds.
SAF7	Explain the importance of the HazCom (Hazard Communication Standard) requirement and MSDSs (Material Safety Data Sheets).
SAF8	Describe fire prevention and fire fighting techniques.
SAF9	Define safe work procedures around electrical hazards.
MAT1	Add, subtract, multiply, and divide whole numbers, with and without a calculator.
MAT2	Use a standard ruler and a metric ruler to measure.
MAT3	Add, subtract, multiply, and divide fractions.
MAT4	Add, subtract, multiply, and divide decimals, with and without a calculator.
MAT5	Convert decimals to percents and percents to decimals.
MAT6	Convert fractions to decimals and decimals to fractions.
MAT7	Explain what the metric system is and how it is important in the construction trade.
MAT8	Recognize and use metric units of length, weight, volume, and temperature.
MAT9	Recognize some of the basic shapes used in the construction industry and apply basic geometry to measure them.
HTO1	Recognize and identify some of the basic hand tools used in the construction trade.
HTO2	Use these tools safely.
HTO3	Describe the basic procedures for taking care of these tools.
PTO1	Identify commonly used power tools of the construction trade.
PTO2	Use power tools safely.
PTO3	Explain how to maintain power tools properly.
BLU1	Recognize and identify basic blueprint terms, components, and symbols.
BLU2	Relate information on blueprints to actual locations on the print.
BLU3	Recognize different classifications of drawings.
BLU4	Interpret and use drawing dimensions.
RIG1	Identify and describe the use of slings and common rigging hardware.
RIG2	Describe the basic inspection techniques and rejection criteria used for slings and hardware.
RIG3	Describe the basic hitch configurations and their proper connections.
RIG4	Describe basic load-handling safety practices.
RIG5	Demonstrate proper use of American National Standards Institute (ANSI) hand signals.
COM1	Demonstrate the ability to understand information and instructions that are presented in both written and verbal form.
COM2	Demonstrate the ability to communicate effectively in on-the-job situations using written and verbal skills.

[1] *Contren learning series*. Retrieved August 14, 2004, from http://www.natef.org

EMP1 Explain the construction industry, the role of the companies that make up the industry, and the role of individual professionals in the industry.
EMP2 Demonstrate critical thinking skills and the ability to solve problems using those skills.
EMP3 Demonstrate knowledge of computer systems and explain common uses for computers in the construction industry.
EMP4 Demonstrate effective relationship skills with teammates and supervisors, exhibit the ability to work on a team, and demonstrate appropriate leadership skills.
EMP5 Be aware of workplace issues such as sexual harassment, stress, and substance abuse.

MILLWRIGHT HAND TOOLS

MHT1 Explain hand tool safety.
MHT2 Use and care for millwright hand tools.

FASTENERS

MFF1 Identify and explain threaded fasteners.
MFF2 Identify and explain nonthreaded fasteners.
MFF3 Identify and explain insulation fasteners.
MFF4 Install fasteners.

BASIC LAYOUT

MBL1 Identify and explain layout tools.
MBL2 Lay out base lines, using the arc method.
MBL3 Lay out base lines, using the 3-4-5 method.
MBL4 Scribe straight lines.
MBL5 Scribe perpendicular lines to a base line, using a square.
MBL6 Scribe perpendicular lines to an edge, using a combination square.
MBL7 Scribe angled lines, using a combination square.
MBL8 Scribe angled lines, using a protractor.
MBL9 Scribe circles, using dividers.
MBL10 Scribe circles, using trammel points.
MBL11 Scribe perpendicular lines from base lines, using dividers.
MBL12 Scribe perpendicular lines from base lines, using reference points.
MBL13 Bisect lines, using dividers.
MBL14 Divide lines into equal parts.
MBL15 Divide circles into equal parts.
MBL16 Lay out equipment locations.

CUTTING AND FITTING GASKETS

MCF1 Identify and explain gasket types.
MCF2 Identify and explain gasket materials.
MCF3 Lay out and cut gaskets.
MCF4 Install gaskets.

OXY-FUEL CUTTING

MOC1 Explain oxy-fuel cutting safety.
MOC2 Identify and explain oxy-fuel cutting equipment.
MOC3 Identify and explain oxy-fuel flames.
MOC4 Identify and explain backfire and flashbacks.
MOC5 Set up oxy-fuel equipment.
MOC6 Light and adjust an oxy-fuel torch.
MOC7 Shut down oxy-fuel cutting equipment.
MOC8 Disassemble oxy-fuel equipment.
MOC9 Change empty cylinders.
MOC10 Perform housekeeping tasks.
MOC11 Perform oxy-fuel cutting:
- Straight-line and square shapes
- Piercing and slot cutting
- Bevels
- Washing
- Gouging

Appendix B: Academic Standards

Algebra I[2]

Competencies and Suggested Objective(s)

A1 Recognize, classify, and use real numbers and their properties.
- a. Describe the real number system using a diagram to show the relationships of component sets of numbers that compose the set of real numbers.
- b. Model properties and equivalence relationships of real numbers.
- c. Demonstrate and apply properties of real numbers to algebraic expressions.
- d. Perform basic operations on square roots excluding rationalizing denominators.

A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- a. Analyze relationships between two variables, identify domain and range, and determine whether a relation is a function.
- b. Explain and illustrate how change in one variable may result in a change in another variable.
- c. Determine the rule that describes a pattern and determine the pattern given the rule.
- d. Apply patterns to graphs and use appropriate technology.

A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
- a. Solve, check, and graph linear equations and inequalities in one variable, including rational coefficients.
- b. Graph and check linear equations and inequalities in two variables.
- c. Solve and graph absolute value equations and inequalities in one variable.
- d. Use algebraic and graphical methods to solve systems of linear equations and inequalities.
- e. Translate problem-solving situations into algebraic sentences and determine solutions.

A4 Explore and communicate the characteristics and operations of polynomials.
- a. Classify polynomials and determine the degree.
- b. Add, subtract, multiply, and divide polynomial expressions.
- c. Factor polynomials using algebraic methods and geometric models.
- d. Investigate and apply real-number solutions to quadratic equations algebraically and graphically.
- e. Use convincing arguments to justify unfactorable polynomials.
- f. Apply polynomial operations to problems involving perimeter and area.

A5 Utilize various formulas in problem-solving situations.
- a. Evaluate and apply formulas (e.g., circumference, perimeter, area, volume, Pythagorean Theorem, interest, distance, rate, and time).
- b. Reinforce formulas experimentally to verify solutions.

[2] *Mississippi mathematics framework—Algebra I*. (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/mathematics/ma_algebra_i.html

c. Given a literal equation, solve for any variable of degree one.
d. Using the appropriate formula, determine the length, midpoint, and slope of a segment in a coordinate plane.
e. Use formulas (e.g., point-slope and slope-intercept) to write equations of lines.

A6 Communicate using the language of algebra.
a. Recognize and demonstrate the appropriate use of terms, symbols, and notations.
b. Distinguish between linear and non-linear equations.
c. Translate between verbal expressions and algebraic expressions.
d. Apply the operations of addition, subtraction, and scalar multiplication to matrices.
e. Use scientific notation to solve problems.
f. Use appropriate algebraic language to justify solutions and processes used in solving problems.

A7 Interpret and apply slope as a rate of change.
a. Define slope as a rate of change using algebraic and geometric representations.
b. Interpret and apply slope as a rate of change in problem-solving situations.
c. Use ratio and proportion to solve problems including direct variation (y=kx).
d. Apply the concept of slope to parallel and perpendicular lines.

A8 Analyze data and apply concepts of probability.
a. Collect, organize, graph, and interpret data sets, draw conclusions, and make predictions from the analysis of data.
b. Define event and sample spaces and apply to simple probability problems.
c. Use counting techniques, permutations, and combinations to solve probability problems.

Biology I[3]

Competencies and Suggested Objective(s)

B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
a. Demonstrate the proper use and care for scientific equipment used in biology.
b. Observe and practice safe procedures in the classroom and laboratory.
c. Apply the components of scientific processes and methods in the classroom and laboratory investigations.
d. Communicate results of scientific investigations in oral, written, and graphic form.

B2 Investigate the biochemical basis of life.
a. Identify the characteristics of living things.
b. Describe and differentiate between covalent and ionic bonds using examples of each.
c. Describe the unique bonding and characteristics of water that makes it an essential component of living systems.

[3] *Mississippi science framework—Biology I.* (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/science/sci_biology_I.html

d. Classify solutions using the pH scale and relate the importance of pH to organism survival.
e. Compare the structure, properties and functions of carbohydrates, lipids, proteins and nucleic acids in living organisms.
f. Explain how enzymes work and identify factors that can affect enzyme action.

B3 Investigate cell structures, functions, and methods of reproduction.
a. Differentiate between prokaryotic and eukaryotic cells.
b. Distinguish between plant and animal (eukaryotic) cell structures.
c. Identify and describe the structure and basic functions of the major eukaryotic organelles.
d. Describe the way in which cells are organized in multicellular organisms.
e. Relate cell membrane structure to its function in passive and active transport.
f. Describe the main events in the cell cycle and cell mitosis including differences in plant and animal cell divisions.
g. Relate the importance of meiosis to sexual reproduction and the maintenance of chromosome number.
h. Identify and distinguish among forms of asexual and sexual reproduction.

B4 Investigate the transfer of energy from the sun to living systems.
a. Describe the structure of ATP and its importance in life processes.
b. Examine, compare, and contrast the basic processes of photosynthesis and cellular respiration.
c. Compare and contrast aerobic and anaerobic respiration.

B5 Investigate the principles, mechanisms, and methodology of classical and molecular genetics.
a. Compare and contrast the molecular structures of DNA and RNA as they relate to replication, transcription, and translation.
b. Identify and illustrate how changes in DNA cause mutations and evaluate the significance of these changes.
c. Analyze the applications of DNA technology (forensics, medicine, agriculture).
d. Discuss the significant contributions of well-known scientists to the historical progression of classical and molecular genetics.
e. Apply genetic principles to solve simple inheritance problems including monohybrid crosses, sex linkage, multiple alleles, incomplete dominance, and codominance.
f. Examine inheritance patterns using current technology (gel electrophoresis, pedigrees, karyotypes).

B6 Investigate concepts of natural selection as they relate to diversity of life.
a. Analyze how organisms are classified into a hierarchy of groups and subgroups based on similarities and differences.
b. Identify characteristics of kingdoms including monerans, protists, fungi, plants and animals.
c. Differentiate among major divisions of the plant and animal kingdoms (vascular/non-vascular; vertebrate/invertebrate).
d. Compare the structures and functions of viruses and bacteria relating their impact on other living organisms.

e. Identify evidence of change in species using fossils, DNA sequences, anatomical and physiological similarities, and embryology.
f. Analyze the results of natural selection in speciation, diversity, adaptation, behavior and extinction.

B7 Investigate the interdependence and interactions that occur within an ecosystem.
a. Analyze the flow of energy and matter through various cycles including carbon, oxygen, nitrogen and water cycles.
b. Interpret interactions among organisms in an ecosystem (producer/consumer/decomposer, predator/prey, symbiotic relationships and competitive relationships).
c. Compare variations, tolerances, and adaptations of plants and animals in major biomes.
d. Investigate and explain the transfer of energy in an ecosystem including food chains, food webs, and food pyramids.
e. Examine long and short-term changes to the environment as a result of natural events and human actions.

English II[4]

Competencies and Suggested Objective(s)

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
a. Produce individual and/or group compositions and/or projects to persuade, tell a story, describe, create an effect, explain or justify an action or event, inform, entertain, etc.
b. Produce writing typically used in the workplace such as social, business, and technical correspondence; explanation of procedures; status reports; research findings; narratives for graphs; justification of decisions, actions, or expenses; etc.
c. Write a response, reaction, interpretation, analysis, summary, etc., of literature, other reading matter, or orally presented material.
d. Revise to ensure effective introductions, details, wording, topic sentences, and conclusions.

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
a. Listen to determine the main idea and supporting details, to distinguish fact from opinion, and to determine a speaker's purpose or bias.
b. Speak with appropriate intonation, articulation, gestures, and facial expression.
c. Speak effectively to explain and justify ideas to peers, to inform, to summarize, to persuade, to entertain, to describe, etc.

E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
a. Read, view, and listen to distinguish fact from opinions and to recognize persuasive and manipulative techniques.

[4] *Mississippi language arts framework—English II*. (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/language_arts/la_10.html

b. Access both print and non-print sources to produce an I-Search paper, research paper, or project.
c. Use computers and audio-visual technology to access and organize information for purposes such as resumes, career search projects, and analytical writings, etc.
d. Use reference sources, indices, electronic card catalog, and appropriate research procedures to gather and synthesize information.

E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
a. Interact with peers to examine real world and literary issues and ideas.
b. Show growth in critical thinking, leadership skills, consensus building, and self-confidence by assuming a role in a group, negotiating compromise, and reflecting on individual or group work.

E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
a. Share, critique, and evaluate works in progress and completed works through a process approach.
b. Communicate effectively in a group to present completed projects and/or compositions.
c. Edit oral and written presentations to reflect correct grammar, usage, and mechanics.

E6 Explore cultural contributions to the history of the English language and its literature.
a. Explore a variety of works from various historical periods, geographical locations, and cultures, recognizing their influence on language and literature.
b. Identify instances of dialectal differences which create stereotypes, perceptions, and identities.
c. Recognize root words, prefixes, suffixes, and cognates.
d. Relate how vocabulary and spelling have changed over time.

E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
a. Listen to and read aloud selected works to recognize and respond to the rhythm and power of language to convey a message.
b. Read aloud with fluency and expression.
c. Analyze the stylistic devices, such as alliteration, assonance, word order, rhyme, onomatopoeia, etc., that make a passage achieve a certain effect.
d. Demonstrate how the use of language can confuse or inform, repel or persuade, or inspire or enrage.
e. Analyze how grammatical structure or style helps to create a certain effect.

E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
a. Read and explore increasingly complete works, both classic and contemporary, for oral discussion and written analysis.
b. Read, discuss, and interpret literature to make connections to life.
c. Read from a variety of genres to understand how the literary elements contribute to the overall quality of the work.

d. Identify qualities in increasingly complex literature that have produced a lasting impact on society.
e. Read for enjoyment, appreciation, and comprehension of plot, style, vocabulary, etc.

E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
a. Infuse the study of grammar and vocabulary into written and oral communication.
b. Demonstrate, in the context of their own writing, proficient use of the conventions of standard English, including, but not limited to, the following: complete sentences, subject-verb agreement, plurals, spellings, homophones, possessives, verb forms, punctuation, capitalization, pronouns, pronoun-antecedent agreement, parallel structure, and dangling and misplaced modifiers.
c. Give oral presentations to reinforce the use of standard English.
d. Employ increasingly proficient editing skills to identify and solve problems in grammar, usage, and structure.

E10 Use language and critical thinking strategies to serve as tools for learning.
a. Use language to facilitate continuous learning, to record observations, to clarify thought, to synthesize information, and to analyze and evaluate language.
b. Interpret visual material orally and in writing.

U. S. History from 1877[5]

Competencies and Suggested Objective(s)

H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
a. Apply economic concepts and reasoning when evaluating historical and contemporary social developments and issues (e.g., gold standard, free coinage of silver, tariff issue, laissez faire, deficit spending, etc.).
b. Explain the emergence of modern America from a domestic perspective (e.g., frontier experience, Industrial Revolution and organized labor, reform movements of Populism and Progressivism, Women's Movement, Civil Rights Movement, the New Deal, etc.).
c. Explain the changing role of the United States in world affairs since 1877 through wars, conflicts, and foreign policy (e.g., Spanish-American War, Korean conflict, containment policy, etc.).
d. Trace the expansion of the United States and its acquisition of territory from 1877 (e.g., expansionism and imperialism).

H2 Describe the impact of science and technology on the historical development of the United States in the global community.
a. Analyze the impact of inventions on the United States (e.g., telephone, light bulb, etc.).
b. Examine the continuing impact of the Industrial Revolution on the development of our nation (e.g., mass production, computer operations, etc.).

[5] *Mississippi social studies framework—U.S. History from 1877*. (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/social_studies/ss_us_history.html

c. Describe the effects of transportation and communication advances since 1877.

H3 Describe the relationship of people, places, and environments through time.

a. Analyze human migration patterns since 1877 (e.g., rural to urban, the Great Migration, etc.).

b. Analyze how changing human, physical, geographic characteristics can alter a regional landscape (e.g., urbanization, Dust Bowl, etc.).

H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).

a. Interpret special purpose maps, primary/secondary sources, and political cartoons.

b. Analyze technological information on graphs, charts, and timelines.

c. Locate areas of international conflict (e.g., Caribbean, Southeast Asia, Europe, etc.).

H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.

a. Examine various reform movements (e.g., Civil Rights, Women's Movement, etc.).

b. Examine the government's role in various movements (e.g., arbitration, 26th Amendment, etc.).

c. Examine the role of government in the preservation of citizens' rights (e.g., 19th Amendment, Civil Rights Act of 1964).

d. Examine individuals' duties and responsibilities in a democratic society (e.g., voting, volunteerism, etc.).

Appendix C: Workplace Skills for the 21st Century[6]

WP1 Allocates resources (time, money, materials and facilities, and human resources).
WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
WP5 Selects, applies, and maintains/troubleshoots technology.
WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

[6] *Secretary's commission on achieving necessary skills*. Retrieved July 13, 2004, from http://wdr.doleta.gov/SCANS/

Appendix D: National Educational Technology Standards for Students[7]

T1 Basic operations and concepts
- Students demonstrate a sound understanding of the nature and operation of technology systems.
- Students are proficient in the use of technology.

T2 Social, ethical, and human issues
- Students understand the ethical, cultural, and societal issues related to technology.
- Students practice responsible use of technology systems, information, and software.
- Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.

T3 Technology productivity tools
- Students use technology tools to enhance learning, increase productivity, and promote creativity.
- Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.

T4 Technology communications tools
- Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
- Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.

T5 Technology research tools
- Students use technology to locate, evaluate, and collect information from a variety of sources.
- Students use technology tools to process data and report results.
- Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.

T6 Technology problem-solving and decision-making tools
- Students use technology resources for solving problems and making informed decisions.
- Students employ technology in the development of strategies for solving problems in the real world.

[7] *ISTE: National educational technology standards (NETS).* Retrieved July 13, 2004, from http://cnets.iste.org/