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CTE Standards Unpacking
Welding Technology

Course: Welding Technology
Course Description: Welding Technology provides students with an understanding of manufacturing processes and systems common to careers in welding and related industries. Welding Technology is based on, but not limited to, American Welding Society (AWS) Guidelines for the Entry Level Welder.
Career Cluster: Manufacturing
Prerequisites: None
Program of Study Application: Welding Technology is the first pathway course in the Manufacturing cluster, welding pathway. It follows a cluster course and is a prerequisite for the Advanced Welding course.

INDICATOR #WT 1: **Identify and understand welding safety**.		
SUB-INDICATOR 1.1 (Webb Level: 2 Skill/Concept): Identify and demonstrate proper industry safety standards.		
Knowledge (Factual): -AWS (American Welding Society) Welding safety certification -Occupational Safety Health Administration (OSHA) certification -Common welding hazards -SDS (Safety Data Sheets) -Proper PPE (Personal Protective Equipment) needed in welding field -Confined Spaces and Tank handling procedures	**Understand (Conceptual):** -Welding safety and allied cutting processes (AWS) -General safety guidelines (OSHA) -Why Welding occupation is a hazardous career -Correct confined space and tank handling procedures for safe workplace	**Do (Application):** -Completion of the AWS online safety seminar (https://www.awslearning.org) -Reviewing the OSHA 10 requirements for certification (https://www.oshaeducationcenter.com) -Describe the importance of welding safety and identify factors related to accidents -Identify and describe respiratory hazards, respiratory safety equipment, and ways to ventilate welding work areas

Benchmarks:
Students will be assessed on their ability to:

- Certification in OSHA 10 and AWS safety will meet the requirements of this Indicator
- Oral or written presentation on hazards of welding

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
SL.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.	-Present findings on welding hazards
W.4 – Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	-Summarize welding hazards

INDICATOR #WT 2: **Read, comprehend, and communicate written and spoken technical terminology and instructions related to welding and welded assemblies.**

SUB-INDICATOR 2.1 (Webb Level: 2 Skill/Concept): Demonstrate mathematical skills related to work assignments.

SUB-INDICATOR 2.2 (Webb Level: 1 Recall): Read and demonstrate understanding of welding terms and definitions from American National Standards Institute (ANSI)/American Welding Society (AWS) A3.0, *Standard Welding Terms and Definitions.*

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Welding math -Welding terminology	-Welding math derived from fractions, decimals, metric conversions in mathematical computations -American Welding Society	-Completion of simple manufacturing work sheets considering formulas for welding fabrication -Interpretation of all

	(AWS) A3.0, Standard Welding Terms and Definitions. Various measuring devices	terms noted in AWS A3.0, Standard Welding Terms and Definition -Demonstrate and record measurements derived from using measuring devices -Analyze the functions of angles and parts of a circle

Benchmarks:
Students will be assessed on their ability to:

- Student will be able to meet requirements for INDICATOR #WT 2 when they have successfully passed a welding terminology and welding math test.
- Construct or layout of parts using the principles of geometry

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
N-Q.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. G-Co. 12 Make formal geometric constructions with a variety of tools and methods	-Students will complete math worksheets using formulas and measuring that correspond to welding techniques -Students will use geometric techniques to create a representation of their work

INDICATOR #WT 3: **Interpret drawings and welding symbol information.**		
SUB-INDICATOR 3.1 (Webb Level: 3 Strategic Thinking): Read and sketch drawings.		
SUB-INDICATOR 3.2 (Webb Level: 1 Recall): Identify basic weld symbols.		
SUB-INDICATOR 3.3 (Webb Level: 1 Recall): Identify lines and joints.		
Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**

-Welding symbols -Blueprint reading -Six possible views of an object -Basic weld symbols and their location significance within the weld symbol -Supplementary weld symbols -Standard and location and the element of weld symbol -Basic joint types -Importance of properly drawn and dimensioned objects	-Weld symbols significance, blueprints and weld drawings	-Completion of Hobart EW-342 training packet. -Identify six possible views of an object -Sketch parts and assign measurements to the sketch -Label objective, hidden, center, break lines -Label butt, tee, lap, edge, corner joints

Benchmarks:
Students will be assessed on their ability to:

- Successful completion of the EW-342 would assure proper knowledge of welding symbols, lines and joints along with sketching of weld drawings

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
G-MG.1 Modeling with Geometry Use geometric shapes, their measures, and their properties to describe objects	-Students will use geometry principals to sketch their work

INDICATOR #WT 4: **Understand and Perform metal cutting operations.**		
SUB-INDICATOR 4.1 (Webb Level: 2 Skill/Concept): Identify and explain the use of oxyfuel and plasma cutting equipment.		
SUB-INDICATOR 4.2 (Webb Level: 2 Skill/Concept): Prepare layouts for cutting individual parts.		
SUB-INDICATOR 4.3 (Webb Level: 2 Skill/Concept): Perform cuts using oxyfuel and plasma cutting processes.		
Knowledge (Factual): -Oxyfuel operations -Plasma cutting functions -Basic design procedures -Appropriate math skills	**Understand (Conceptual):** -Knowledge of Oxyfuel components -Operations of Oxyfuel cutting systems -Proper setting of plasma parameters -Proper layout parameters for individual parts	**Do (Application):** -Set up oxyfuel equipment -Light and adjust an oxyfuel torch -Shut down oxyfuel cutting equipment -Disassemble oxyfuel equipment -Change cylinders on oxyfuel equipment -Use a combination torch with welding, cutting and heating attachments -Properly set plasma cutting parameters -Identify parts of the plasma system torch: electrode, nozzle, contact tip, etc. -Utilize rulers, straightedges, chalk lines, scribes and other layout equipment to make a layout suitable for guiding a cutting operation -Use principles of algebra and geometry to assist in

		complex layout operations

Benchmarks:
Students will be assessed on their ability to:

- Perform proper cutting operations
- Perform proper layout procedures

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
PS1-5 Construct an explanation based on evidence about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.	-Students will utilize explanation to properly maintain oxyfuel reaction.
G-mG.3 Apply geometric methods to solve design problems	-Students will use geometry to analyze layouts and design.

INDICATOR #WT 5: **Exhibit knowledge and perform base metal preparation.**

SUB-INDICATOR 5.1 (Webb Level: 2 Skill/Concept): prepare base metal for various welding processes.

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Material preparation for welding processes -Welding terminology	-Proper preparation of base materials in order to complete welding assignments	-Clean base metal for welding or cutting -Explain joint design considerations -Mechanically bevel the edge of a mild steel plate -Thermally bevel the end of a mild steel plate -Select the proper joint design based on a welding procedure

		specification (WPS) or instructor direction

Benchmarks:
Students will be assessed on their ability to:

- Perform proper steps for base metal preparation following industry standards

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
PS2-6 Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials	-Students will report findings of molecular structure in welding techniques

INDICATOR #WT 6: **Understand and Perform Shielded Metal Arc Welding (SMAW) process**

SUB-INDICATOR 6.1 (Webb Level: 1 Recall): Identify and understand SMAW equipment and setup.

SUB-INDICATOR 6.2 (Webb Level:,1 Recall): Define and understand the application for different Shielded Metal Arc (SMAW) electrodes.

SUB-INDICATOR 6.3 (Webb Level: 2 Skill/Concept): Demonstrate knowledge of Shielded Metal Arc Welding (SMAW) process.

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Shielded Metal Arc Welding essentials -SMAW classification system -SMAW skill development -Electrodes	-Welding electrical circuit -Welding power supplies -Machine set up -Proper electrode selection -SMAW position applications	-Identify and explain shielded metal arc welding (SMAW) safety -Explain welding electrical circuit -Identify welding power supplies and their characteristics -Explain how to set up welding power supplies -Set up a machine for welding

		-Understand the difference between Direct Current Electrode Positive (DCEP) and Direct Current Electrode Negative (DCEN) -Identify electrodes using the AWS specifications -Identify factors that affect electrode selection -Identify different types of filler metals -Explain the storage and control of filler metals -Identify and select the proper electrode for a specific welding task -Demonstrate fillet welds in one or more positions. -Demonstrate grove welds in one or more positions -Complete a test plate in one or more positions

Benchmarks:
Students will be assessed on their ability to:

- Practice appropriate SMAW safety protocol
- Proper SMAW equipment instillation
- Demonstrate SMAW skill level

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**

PS1-3 Plan and carry out an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.	-Students will report findings on electrodes and electrical forces
PS3-5 Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.	-Students will illustrate electrodes and electrical fields as they relate to SMAW equipment.

INDICATOR #WT 7: **Identify and demonstrate knowledge of quality control of the welding process.**		
SUB-INDICATOR 7.1 (Webb Level: 3 Strategic Thinking): Demonstrate knowledge of weld quality		
Knowledge (Factual): -Weld acceptability	**Understand (Conceptual):** -Codes governing welding -Weld defects and discontinuities Nondestructive/destructive examination practices -Welder performance testing tests	**Do (Application):** -Identify and explain codes governing welding -Identify and explain weld imperfections and their causes -Identify and explain nondestructive examination practices -Identify and explain welder qualification tests -Explain the importance of quality workmanship -Identify common destructive testing methods -Perform visual inspection of fillet welds

Benchmarks: *Students will be assessed on their ability to:* • Document and explain acceptable weld • Identify and explain weld discontinuity • Code relevancy exams		
Academic Connections		
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): PS3-1 Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known	**Sample Performance Task Aligned to the Academic Standard(s):** -Students will be able to model the energy flow in the welding process.	

INDICATOR #WT 8: **Participate in career exploration activities**		
SUB-INDICATOR 8.1 (Webb Level: 2 Skill/Concept): Research career opportunities in manufacturing/welding fields.		
Knowledge (Factual): -Career opportunities in manufacturing/welding fields	**Understand (Conceptual):** -Manufacturing career paths	**Do (Application):** -Utilize career exploration software -Research and write a report on career opportunities in the manufacturing field -Utilize the career exploration software to research educational requirements for a chosen career path -Utilize career

		exploration software, update a student portfolio -Invite local industry experts to speak in the classroom

Benchmarks:
Students will be assessed on their ability to:

- Create a list of career opportunities that are linked to career match maker section of www.sdmylife.com
- Presentation on career choice

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
RI.7 Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem	-Read technical publications
W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience	-List of occupations
SL.2. Integrate multiple sources of information presented in diverse formats and media	-Through the interview process student will form a presentation on career choices.

INDICATOR #WT 9: **Practice ethical work behaviors**

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SUB-INDICATOR 9.1 (Webb Level:1 Recall): Students will follow the following required ethical practices of Manufacturing Industry:		
Knowledge (Factual): -Employer handbook -Ethical practices of the Manufacturing Industry	**Understand (Conceptual):** -Employer mandated work rules	**Do (Application):** -Complete assignments efficiently and on time -Be aware of the importance of attendance -Utilize principles of time management -Present a positive attitude -Work well with peers/supervisor -Be prepared for work assignments

Benchmarks:
Students will be assessed on their ability to:

- Role play appropriate and inappropriate actions in the workplace

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
SL.4 Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.	-Role play for interviewing for a job

Additional Resources
Lake Area Tech (https://www.lakeareatech.edu/)
Mitchell Tech (https://www.mitchelltech.edu/)

Western Dakota Tech (https://www.wdt.edu/)
South Dakota Industry