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| **TEXAS CTE LESSON PLAN**[www.txcte.org](http://www.txcte.org) |
| **Lesson Identification and TEKS Addressed** |
| **Career Cluster** | Manufacturing |
| **Course Name** | Welding I |
| **Lesson/Unit Title** | Basic Metals |
| **TEKS Student Expectations** | **130.363. (c) Knowledge and Skills**(4) The student evaluates the function and application of the tools, equipment, technologies, and materials used in welding. (A) The student is expected to operate welding equipment according to safety standards(B) The student is expected to identify and properly dispose of environmentally hazardous materials used in welding(D) The student is expected to choose appropriate personal protective equipment  |
| **Basic Direct Teach Lesson**(Includes Special Education Modifications/Accommodations and one English Language Proficiency Standards (ELPS) Strategy) |
| **Instructional Objectives** | The student will be able to:* Define ferrous and non-ferrous, alloy and alloy steels
* Identify various metals
* Identify standard metal shapes
* Determine characteristics and uses of various metals
* Evaluate information from a spark test
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| **Rationale** | It is critical that students are able to identify various types of metals and their properties. |
| **Duration of Lesson** | The lesson should take approximately four (45 minute) class periods to teach and complete the activities. |
| **Word Wall/Key Vocabulary***(ELPS c1a,c,f; c2b; c3a,b,d; c4c; c5b) PDAS II(5)* | **Alloy -** metal formed by melting, fusing, or mixing two or more metals together**Alloy steel -** steel with one or more other metals added to give the steel certain characteristics orproperties (always ferrous)**Appendage -** a subordinate part connected to the main part**Carbon** - main hardening agent in steel**Conductor -** a material that allows electricity or heat to pass through it**Ductile -** capable of being drawn out into wire**Ferrous -** metal that contains iron as a major element**Galvanize -** to produce a coating of zinc to prevent rusting**Lustrous -** reflecting light evenly**Malleable -** capable of being stretched or bent**Metallurgy -** the science of separating metals from their ores and then smelting, or refining them foruse**Non-Ferrous -** metal that contains no iron or extremely small amounts of iron**Sprigs -** a small shoot**Weldment -** assembly of two or more metal parts with welding |
| **Materials/Specialized Equipment Needed** | **Materials*** Sample pieces of flat metal
* Sample pieces of various shaped metals (at least 15)

**Equipment*** Safety goggles
* Grinder
* Computer
* Projector

**Learner Preparation*** The student should provide writing instrument and paper for note-taking.
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| **Anticipatory Set**(May include pre-assessment for prior knowledge) | **Say**In welding, many different types of materials are joined together. The school welding shop is limited in the types of materials, but it is necessary to know the most commonly used metals in the field of welding.**Ask**Why is it necessary to know the most commonly used metals in the field of welding?**Say**Knowledge of the materials will help you make better choices concerning filler metals and uses of the fabrication.**Show**Any array of types of metal piecesMetal pieces (round bar, half-round bar, oval bar, half-oval bar, square bar, hexagon bar, flat bar, H-beam, I-beam, channel, angle, flat plate, tubing, and pipe) |
| **Direct Instruction \*** | 1. Terms
	1. Alloy
	2. Alloy Steel
	3. Appendage
	4. Conductor
	5. Ductile
	6. Ferrous
	7. Galvanize
	8. Lustrous
	9. Malleable
	10. Metallurgy
	11. Non-ferrous
	12. Sprigs
	13. Weldment
2. Types of Metals
	1. Students take notes and fill in Characteristics and Uses of Metals handout.
	2. Teacher may choose to present an example of the following metal pieces.
		1. Nickel steel
		2. Chromium steel
		3. Stainless steel
		4. Plain carbon steel
		5. Low-alloy steel
		6. Chrome-nickel steel
		7. Manganese steel
		8. Molybdenum steel
		9. Tungsten steel
		10. Magnet steel
		11. Tungsten carbide
		12. Vanadium steel
		13. Stellite
		14. High-speed steel
		15. Wrought iron
		16. Gray cast iron
		17. White cast iron
		18. Malleable cast iron
		19. Aluminum
		20. Copper
		21. Zinc
		22. Magnesium
		23. Nickel
		24. Titanium
		25. Lead
		26. Tin
	3. Review Surface Color of Common Metals handout
3. Basic Metal Shapes
	1. Students take notes on *Basic Metal Shapes* *Handout 1* OR *Handout 2*.
	2. Teacher should pass around examples of metal shapes.
		1. Round bar
		2. Half-round bar
		3. Oval bar
		4. Half-oval bar
		5. Square bar
		6. Hexagon bar
		7. Flat bar
		8. H-beam
		9. I-beam
		10. Channel
		11. Angle
		12. Flat plate
		13. Tubing and pipe
4. Spark Tests
	* + 1. Teacher demonstrates a spark test checking with the students at each step to make sure they understand the procedure
			2. Teacher divides the class into two small groups
			3. Send each group separately to the grinder station
			4. At the grinder station, each group will test the sample metal piece provided by the teacher
			5. After all groups have tested the metal, have the class discuss the results and determine the type of metal
			6. Change the metal type and repeat the test process several times
			7. Each student will use the *Spark Test Record Sheet* to record the results and findings

*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:*none |
| **Guided Practice \*** | Guide the spark test and follow up discussion to evaluate metal types. Students may use their notes.*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:*none |
| **Independent Practice/Laboratory Experience/Differentiated Activities \*** | * Students will take notes and complete the *Characteristics* *and Uses of Metals* handout.
* Students will take notes on the *Basic Metal Shapes* *Handouts 1 and 2*.

*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:*none |
| **Lesson Closure** | Check for mastery/understanding by orally reviewing students on the information. Ask individual students to identify pieces of metal or metal shapes. |
| **Summative/End of Lesson Assessment \***  | **Informal Assessment**The teacher will monitor students’ understanding throughout the lesson. If further explanation is needed on a given topic, the teacher should elaborate or re-teach that portion of the lesson. During review time, check each student for general mastery level.**Formal Assessment**Mastery of at least 70% on the *Basic Metals Test* over types of metals and metal shapes will be required.*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:*These lessons accommodate the needs of every learner. Modify the lessons to accommodate your students with learning differences by referring to the files found on the Special Populations page of this website.  |
| **References/Resources/****Teacher Preparation** | * Fortney, C. & Fulkerson, D. & Gregory, M. (1984). Gas tungsten arc welding. Stillwater, OK: Mid-America Vocational Curriculum Consortium.
* Althouse, A. D. & Bowditch, W. A. & Bowditch, K. E. & Bowditch, K. & Bowditch, M. A. (2004). Modern welding. Tinley Park, IL: Goodheart-Willcox.
* Jeffus, L. F. (1999). Welding principles and applications. (4th ed.) Independence, KY: Cengage Learning.
* *Characteristics and Uses of Metals* handout
* *Surface Color of Common Metals* handout
* *Basic Metal Shapes Handout 1*
* *Basic Metal Shapes Handout 2*
* *Basic Metal Shapes Handouts 1 and 2 Answer Key*
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| **Additional Required Components** |
| **English Language Proficiency Standards (ELPS) Strategies** |  |
| **College and Career Readiness Connection[[1]](#footnote-1)** | **Occupational Correlation** (O\*Net–[www.onetonline.org/](http://www.onetonline.org/))**Job Title:** Welders, Cutters, and Welder Fitters**O\*Net Number:** 51-4121.06**Reported Job Titles:** Aluminum Welder, Fabrication Welder, Fabricator, Fitter/Welder, Maintenance Welder,Mig Welder, Sub Arc Operator, Welder, Welder-Fitter, Welder/Fabricator |
| **Recommended Strategies** |
| **Reading Strategies** |  |
| **Quotes** |  |
| **Multimedia/Visual Strategy****Presentation Slides + One Additional Technology Connection** |  |
| **Graphic Organizers/Handout** |  |
| **Writing Strategies****Journal Entries + 1 Additional Writing Strategy** |  |
| **Communication****90 Second Speech Topics** |  |
| **Other Essential Lesson Components** |
| **Enrichment Activity**(e.g., homework assignment) |  |
| **Family/Community Connection** |  |
| **CTSO connection(s)** | SkillsUSA |
| **Service Learning Projects** |  |
| **Lesson Notes** |  |

1. Visit the Texas College and Career Readiness Standards at <http://www.thecb.state.tx.us/collegereadiness/CRS.pdf>, Texas Higher Education Coordinating Board (THECB), 2009. [↑](#footnote-ref-1)