



**SPRING GROVE AREA SCHOOL DISTRICT**



**PLANNED COURSE OVERVIEW**

<b>Course Title:</b> Metal Fabrication <b>Grade Level(s):</b> 10-12 <b>Units of Credit:</b> .5 <b>Classification:</b> Elective	<b>Length of Course:</b> Half Year <b>Periods Per Cycle:</b> 6 <b>Length of Period:</b> 40 Minutes <b>Total Instructional Time:</b> 60 Hours
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***Course Description***

This course provides the opportunity to investigate and experiment with various metal materials and processes while observing their properties. A strong emphasis will be placed on the application of math and scientific principles, building connections with local business and trade groups, as well as technological impacts on industry and society. Students will also develop an understanding of the economic and business aspects of the supply chain, bidding, project lists, finite resources, and sustainability.

***Instructional Strategies, Learning Practices, Activities, and Experiences***

Build Upon and Develop Minimum Competency Skills (MICS) Develop Competency Skills Design and Self-Reflect for Problem Solving and Enhancement	Independent Research Project Construction Posted Objectives and Agendas	Bell Ringers Design, Build, Practice, Assess Process Journal Logs Constructive Responses
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***Assessments***

Journals Weekly Checkpoints Small Group Discussions	Independent Projects Group Projects Panels of Experts	Interviews with Local Businesses and Organizations
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***Materials/Resources***

Technology Procedures and Equipment Instructor Provided Rubrics	Daily, Weekly, and Monthly Student Created Objectives Daily, Weekly, and Monthly Teacher Created Objectives	Various Materials Determined by Student(s)' Needs Community Business Partnerships Earl Beck Welding Tekgard
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**Adopted:** 5/22/23

**Revised:**

<b>Unit 1 Safety and Introduction to Metal Lab</b>	
<b>CONTENT/KEY CONCEPTS</b>	<b>OBJECTIVES/STANDARDS</b>
Lab Safety Hand and Power Tools	<p><b>Objectives:</b> SWBAT demonstrate safety procedures within the metal shop. SWBAT safely use tools and machines as well as the appropriate PPE within the metal shop.</p> <p><b>Next Generation Science Standards (NGSS):</b> HS-ETS1-2 - Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. HS-ETS1-3 - Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.</p> <p><b>Minimum Competency Skills:</b> The students will identify safe behaviors required for a lab setting. The students will identify PPE for each process for metals. The students will identify hand tools and their intended purpose. The students will identify metal fabrication machines and their intended purpose. The students will have the ability to design their safety plan and implementation.</p>

Unit 2 Measurement and Blueprint Interpretation	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
<p>Students will use various measuring tools to fabricate metal to specific dimensions.</p>	<p><b>Objectives:</b>                      Students will use various measuring tools to layout materials to a tolerance of <math>\pm 1/16"</math>.                      Students will use various cutting tools and machines to cut materials to a tolerance of <math>\pm 1/16"</math>.                      Students will use detailed blueprints to fabricate materials to a tolerance of <math>\pm 1/16"</math>.</p> <p><b>Next Generation Science Standards (NGSS):</b>                      HS-ETS1-1 - Analyze a major global or District challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.                      HS-ETS1-2 - Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.                      HS-ETS1-3 - Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.</p> <p><b>Minimum Competency Skills:</b>                      The student will have the ability to measure and cut materials accurate to within 1/16 of an inch.                      The student will have the ability to make proper adjustments to a miter saw as needed for a cut.                      The student will have the ability to identify hand tools used to work with metals, and safely use specified tool.                      The student will have the ability to design a layout procedure by referencing blueprints.</p>

Unit 3 – Metal Identification and Processes	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
<p>Students will learn about various types of metals.</p>	<p><b>Objectives:</b>                      SWBAT will differentiate between hot metals and cold metals.                      SWBAT demonstrate the appropriate processes to manufacture each metal.                      Students demonstrate use of the appropriate cutting tool to manufacture metal.</p> <p><b>Next Generation Science Standards (NGSS):</b>                      HS-ETS1-1 - Analyze a major global or District challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.                      HS-ETS1-2 - Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.                      HS-ETS1-3 - Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.</p> <p><b>Minimum Competency Skills:</b>                      The student will have the ability to identify, and use required PPE metal fabrication.                      The students will have the ability to identify hot metals and cold metals.                      The students will have the ability to differentiate between ferrous and nonferrous metals.                      The students will have the ability to identify the melting point of the metal they are fabricating.                      The students will have the ability to identify the process for fastening metals together.                      The student will have the ability to design fastening fixtures to ensure safety, and quality of work.                      The student will have the ability to refine their fixtures based on feedback.</p>

Unit 4 Hot Metals	
CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
<p>Students will learn about various forming and fastening techniques.</p>	<p><b>Objectives:</b>                      SWBAT demonstrate the process of forging &amp; heat treating.                      SWBAT demonstrate the three processes of welding.</p> <p><b>Next Generation Science Standards (NGSS):</b>                      HS-ETS1-1 - Analyze a major global or District challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.                      HS-ETS1-2 - Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.                      HS-ETS1-3 - Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.</p> <p><b>Minimum Competency Skills:</b>                      Students will have the ability to read blueprints to fabricate materials to a tolerance of <math>\pm 1/16"</math>.                      The student will have the ability to identify, and use required PPE for welding.                      The student will have the ability to identify gases used for welding.                      The student will have the ability to weld metals using all three processes.                      The student will have the ability to set the welder for various types of metals regarding wire feed and voltage, and PSI of shielding gases.                      The student will have the ability to identify various diodes for stick welding and use the proper diode for the metal they are welding.                      The student will have the ability to weld metals at 45- or 90-degree angles.                      The student will have the ability to identify metals that can be forged.                      The student will have the ability to explain the steps used to forge and finish metals.                      The student will have the ability to identify the temperature to properly forge.                      The student will have the ability to explain what quenching is and why the process is important                      The student will have the ability to identify PPE when forging hot metals.                      The student will have the ability to identify and safely use hand tools when forging.                      The student will have the ability to heat and bend steel to specific dimensions.                      The student will have the ability to design a bending and forming fixture to ensure safety and quality.                      The student will have the ability to use feedback to improve their fixture.</p>

<b>Unit 5 Cold Metals</b>	
<b>CONTENT/KEY CONCEPTS</b>	<b>OBJECTIVES/STANDARDS</b>
<p>Students will learn about various forming and molding techniques.</p>	<p><b>Objectives:</b>                      SWBAT demonstrate sheet metal fabrication.                      SWBAT demonstrate metal fabrication using a lathe, and milling machine.</p> <p><b>Next Generation Science Standards (NGSS):</b>                      HS-ETS1-1 - Analyze a major global or District challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.                      HS-ETS1-2 - Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.                      HS-ETS1-3 - Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.</p> <p><b>Minimum Competency Skills:</b>                      The student will have the ability to use a measuring tool to measure to a tolerance of +- 1/16".                      The student will have the ability to use a micrometer to measure to the nearest .001".                      The student will have the ability to identify various gauges of sheet metal.                      The student will have the ability to select and use appropriate hand tools sheet metal fabrication.                      The student will have the ability to read and interpret blueprints for sheet metal fabrication.                      The student will have the ability to identify and safely use various sheet metal shaping machines.                      The student will have the ability to identify, and use required PPE for spot welding.                      The student will have the ability to safely fuse sheet metal together with a spot welder.                      The student will have the ability to select the proper size pop rivet for fastening sheet metal.                      The student will have the ability to identify the axis of a lathe.                      The student will have the ability to secure material and safely operate a metal lathe.                      The student will have the ability to turn and shape metal using a metal lathe.                      The student will identify turning speeds for specific metals being fabricated.                      The student will identify the proper cutting tool for the specific metal they are turning.                      The student will safely operate the metal milling machine.</p>

<b>Unit 5 Cold Metals (Continued)</b>	
<b>CONTENT/KEY CONCEPTS</b>	<b>OBJECTIVES/STANDARDS</b>
	<p>The student will properly secure metal to be processed on the mill.</p> <p>The student will have the ability to safely operate and change tooling on the milling machine.</p> <p>The student will have the ability to identify various speeds and cutting tools for specified metals on the mill.</p> <p>The student will identify the axis of the mill.</p> <p>The student will have the ability to design a holding mechanism for machining operations.</p> <p>The student will have the ability to improve their mechanism based on feedback.</p>