Unit 3: Hot Metal Foundry Project and Forging Techniques

Content Area: **Industrial Technology**
Course(s): **Manufacturing Technology I**
Time Period: **2nd Marking Period**
Length: **3 Weeks**
Status: **Published**

Unit Overview

Students will be able to make their own pattern or a pre made pattern to ram up a mold and pour molten aluminum metal into the mold to create a project. Students will use the basic hand forging techniques to create a individual project for the third marking period if they select to.

MANU.9-12.9.4.12.M.(1).7	Design a new product that meets identified customer needs, while also demonstrating the use of strategies and techniques for developing manufacturing production processes.
MANU.9-12.9.4.12.M.(4).6	Employ processes, data, and tools to produce a product that satisfies customer needs for quality, value-added products.
MANU.9-12.9.4.12.M.33	Demonstrate knowledge of personal and jobsite safety rules and regulations to maintain safe and healthful working conditions and environments.
MANU.9-12.9.4.12.M.35	Identify emergency procedures that are necessary to provide aid in workplace accidents.
MANU.9-12.9.4.12.M.41	Assess types and sources of workplace hazards common to manufacturing business environments in order to maintain safe working conditions.
MANU.9-12.9.4.12.M.42	Demonstrate understanding of how to control workplace hazards in manufacturing business environments in order to maintain safe working conditions.
MANU.9-12.9.4.12.M.62	Examine employment opportunities in entrepreneurship as an option for career planning.
MANU.9-12.9.4.12.M.65	Describe and employ technical knowledge and skills required for careers in manufacturing in order to perform basic workplace activities.

Transfer

Students will be able to independently use their learning to...

Create a Aluminum Casting Project using techniques learned from lessons and demonstrations, Students may select to do a metal forging as their third marking period class.

For more information, read the following article by Grant Wiggins.

http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60

Meaning

Students will learn how many of the products that are used today are created through Metal Casting and Forging Processes.

Understandings

Students will understand that...

Students will learn how many of the products that are used today are created through Metal Casting and Forging Processes

Students will learn how 3 dimensional objects can be transformed from non durable materials to a more durable object using casting, and that a forged part is much stronger than a casted part do to compaction of the metal grains. Also that through heating processes the metallurgy of material can be changed to soften or harden the material.

Essential Questions

Students will keep considering...

What are the steps required to make a finished casting?

What is die casting used for?

What is Permanent mold casting?

What are 3D methods of producing a pattern?

Why is a forged part stronger and heavier than a cast part?

How can steel or other metals be changed through heat treating?

Application of Knowledge and Skill

Students will be able to create a pattern or use a pre made pattern to pour a metal casting project.

Students will be able to create a project through metal forging if they chose to select this technique as an individual project.

Students will know...

Students will know...

SWBAT ram up a foundry project and cut the gating system to allow metal to flow into the pattern.

SWBAT wear the proper safety equipment for handling molten metal.

SWBAT safely charge the crucible with aluminum and light the crucible furnace.

SWBAT safely pour molten metal into gating system.

SWBAT machine and polish metal casting.

SWBAT heat steel up to proper temperature and use metal tongs and proper blacksmithing tools to shape metal.

Students will be skilled at...

Students will be skilled at...

SWBAT ram up a foundry project and cut the gating system to allow metal to flow into the pattern.

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SWBAT safely charge the crucible with aluminum and light the crucible furnace.

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Academic Vocabulary

casting, core box, draft, fillets, flask, foundry, mold, pattern, shrink rule, slag, cold forming, drawing out, drop forging, forge, forging, press forging, pritchel hole, roll forging, rotary forging, upsetting

Learning Goal 1

SWBAT explain the sand casting process and describe simple patterns, split patterns, and match plate patterns.

- SWBAT explain the sand casting process and describe simple patterns, split patterns, and match plate patterns.

CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.
CAEP.9.2.12.C.6	Investigate entrepreneurship opportunities as options for career planning and identify the knowledge, skills, abilities, and resources required for owning and managing a business.
MANU.9-12.9.4.12.M.(1).2	Research new manufacturing processes to manage production of new and/or improved products.
MANU.9-12.9.4.12.M.1	Demonstrate language arts knowledge and skills required to pursue the full range of postsecondary education and career opportunities.
MANU.9-12.9.4.12.M.4	Select and employ appropriate reading and communication strategies to learn and use technical concepts and vocabulary in practice.
MANU.9-12.9.4.12.M.11	Apply active listening skills to obtain and clarify information.
MANU.9-12.9.4.12.M.15	Employ critical thinking skills (e.g., analyze, synthesize, and evaluate) independently and in teams to solve problems and make decisions.
MANU.9-12.9.4.12.M.19	Employ technological tools to expedite workflow.
MANU.9-12.9.4.12.M.21	Operate Internet applications to perform tasks.
MANU.9-12.9.4.12.M.33	Demonstrate knowledge of personal and jobsite safety rules and regulations to maintain safe and healthful working conditions and environments.
MANU.9-12.9.4.12.M.35	Identify emergency procedures that are necessary to provide aid in workplace accidents.
MANU.9-12.9.4.12.M.39	Maintain safe and healthful working conditions and environments to ensure employee safety.
MANU.9-12.9.4.12.M.50	Apply ethical reasoning to a variety of situations in order to make ethical decisions.
MANU.9-12.9.4.12.M.54	Demonstrate skills related to seeking and applying for employment in a desired job.

Target 1

SWBAT view different types of patterns that are available for sand casting and the way patterns can be developed by the student to create a pattern. (Examples) 3D Printing, styrofoam, wood patterns.

- SWBAT view different types of patterns that are available for sand casting and the way patterns can be developed by the student to create a pattern. (Examples) 3D Printing, styrofoam, wood patterns.

Target 2

SWBAT select pattern type for the project and begin to ram up casting in the foundry area.

- SWBAT select pattern type for the project and begin to ram up casting in the foundry area.

Learning Goal 2

SWBAT ram up casting project and cut proper gating system to allow the metal to flow into pattern created. SWBAT light crucible furnace safely and pour molten metal safely into gating system created.

- SWBAT ram up casting project and cut proper gating system to allow the metal to flow into pattern created. SWBAT light crucible furnace safely and pour molten metal safely into gating system created.

CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.
CAEP.9.2.12.C.4	Analyze how economic conditions and societal changes influence employment trends and future education.
MANU.9-12.9.4.12.M.(1).2	Research new manufacturing processes to manage production of new and/or improved products.
MANU.9-12.9.4.12.M.(1).3	Develop quality improvement processes to maintain quality during the manufacturing production process.
MANU.9-12.9.4.12.M.(1).6	Assess and select a variety of techniques and solutions to ensure safe production of products as well as safe and productive workplaces.
MANU.9-12.9.4.12.M.(2).4	Describe production process audits and inspections used to maintain quality and encourage continuous improvement.
MANU.9-12.9.4.12.M.(2).6	Research the safe use of manufacturing process equipment in order to protect personal well-being in the work environment.
MANU.9-12.9.4.12.M.(3).9	Identify and diagnose equipment problems in order to effectively repair manufacturing equipment.
MANU.9-12.9.4.12.M.(6).5	Analyze safety inspections findings and implement appropriate safety practices in order to

	improve the health and safety of manufacturing workplaces.
MANU.9-12.9.4.12.M.(6).7	Demonstrate the safe use of manufacturing equipment in order to assure heath and safety in work environments.
MANU.9-12.9.4.12.M.1	Demonstrate language arts knowledge and skills required to pursue the full range of postsecondary education and career opportunities.
MANU.9-12.9.4.12.M.3	Demonstrate science knowledge and skills required to pursue the full range of postsecondary education and career opportunities.
MANU.9-12.9.4.12.M.4	Select and employ appropriate reading and communication strategies to learn and use technical concepts and vocabulary in practice.
MANU.9-12.9.4.12.M.7	Evaluate and use information resources to accomplish specific occupational tasks.
MANU.9-12.9.4.12.M.8	Use correct grammar, punctuation, and terminology to write and edit documents.
MANU.9-12.9.4.12.M.11	Apply active listening skills to obtain and clarify information.
MANU.9-12.9.4.12.M.13	Listen to and speak with diverse individuals to enhance communication skills.
MANU.9-12.9.4.12.M.16	Employ critical thinking and interpersonal skills to resolve.
MANU.9-12.9.4.12.M.21	Operate Internet applications to perform tasks.
MANU.9-12.9.4.12.M.27	Employ computer operations applications to manage tasks.
MANU.9-12.9.4.12.M.33	Demonstrate knowledge of personal and jobsite safety rules and regulations to maintain safe and healthful working conditions and environments.
MANU.9-12.9.4.12.M.35	Identify emergency procedures that are necessary to provide aid in workplace accidents.
MANU.9-12.9.4.12.M.54	Demonstrate skills related to seeking and applying for employment in a desired job.

Target 1

SWBAT ram up the pattern in the flask using molding sand and then cut the gating system into the sand. A pouring basin, sprue, and in gates should be created and the pattern should be removed.

- SWBAT ram up the pattern in the flask using molding sand and then cut the gating system into the sand. A pouring basin, sprue, and in gates should be created and the pattern should be removed.

Target 2

SWBAT safely charge the crucible with solid aluminum and place crucible in the crucible furnace. SWBAT light the furnace safely using the proper gas to air ratio and allow the metal to come up to the proper temperature and then safely pour the metal into the flask.

- SWBAT safely charge the crucible with solid aluminum and place crucible in the crucible furnace. SWBAT light the furnace safely using the proper gas to air ratio and allow the metal to come up to the proper temperature and then safely pour the metal into the flask.

Learning Goal 3

SWBAT to apply the proper types of Forging Techniques to an Individual Project.

- SWBAT to apply the proper types of Forging Techniques to an Individual Project.

CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.
MANU.9-12.9.4.12.M.(2).8	Maintain equipment, tools, and workstations to provide safe work environments and meet company regulations.
MANU.9-12.9.4.12.M.(2).9	Design a product that satisfies a customer's desires to demonstrate the relationship between production processes and meeting customer needs.
MANU.9-12.9.4.12.M.(3).5	Develop hands-on knowledge of equipment operation to identify maintenance needs and maximize performance.
MANU.9-12.9.4.12.M.(4).3	Evaluate production operations for product and process quality to maintain quality assurance.
MANU.9-12.9.4.12.M.(6).7	Demonstrate the safe use of manufacturing equipment in order to assure heath and safety in work environments.
MANU.9-12.9.4.12.M.3	Demonstrate science knowledge and skills required to pursue the full range of postsecondary education and career opportunities.
MANU.9-12.9.4.12.M.4	Select and employ appropriate reading and communication strategies to learn and use technical concepts and vocabulary in practice.
MANU.9-12.9.4.12.M.7	Evaluate and use information resources to accomplish specific occupational tasks.
MANU.9-12.9.4.12.M.11	Apply active listening skills to obtain and clarify information.
MANU.9-12.9.4.12.M.13	Listen to and speak with diverse individuals to enhance communication skills.
MANU.9-12.9.4.12.M.19	Employ technological tools to expedite workflow.
MANU.9-12.9.4.12.M.21	Operate Internet applications to perform tasks.
MANU.9-12.9.4.12.M.32	Analyze and summarize how manufacturing businesses improve performance to demonstrate an understanding of various methods for enhancing production.
MANU.9-12.9.4.12.M.33	Demonstrate knowledge of personal and jobsite safety rules and regulations to maintain safe and healthful working conditions and environments.
MANU.9-12.9.4.12.M.39	Maintain safe and healthful working conditions and environments to ensure employee safety.
MANU.9-12.9.4.12.M.41	Assess types and sources of workplace hazards common to manufacturing business environments in order to maintain safe working conditions.
MANU.9-12.9.4.12.M.54	Demonstrate skills related to seeking and applying for employment in a desired job.
MANU.9-12.9.4.12.M.56	Demonstrate skills in evaluating and comparing employment opportunities in order to accept employment positions that match career goals.
MANU.9-12.9.4.12.M.62	Examine employment opportunities in entrepreneurship as an option for career planning.
MANU.9-12.9.4.12.M.65	Describe and employ technical knowledge and skills required for careers in manufacturing in order to perform basic workplace activities.

Target 1

SWBAT operate equipment and hand tools to safely create a project by cold forging.

- SWBAT operate equipment and hand tools to safely create a project by cold forging.

Target 2

SWBAT operate equipment and hand tools to safely creat a project by hot forging.

- SWBAT operate equipment and hand tools to safely creat a project by hot forging.

Summative Assessment

SWBAT pass safety tests on Casting, Forging and Equipment. Example (Crucible Furnace)

21st Century Life and Careers

CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.
CAEP.9.2.12.C.4	Analyze how economic conditions and societal changes influence employment trends and future education.
CAEP.9.2.12.C.6	Investigate entrepreneurship opportunities as options for career planning and identify the knowledge, skills, abilities, and resources required for owning and managing a business.

Formative Assessment and Performance Opportunities

Students grade will be based on completion of project and craftsmanship of project.

Accommodations/Modifications

Students can assist other students that are behind on other projects. Students can develop their own patterns and project designs for casting and forging.

Unit Resources

Modern Metalworking Instructor's Manual by John R. Walker

Modern Metalworking Textbook by John R. Walker

Modern Metalworking Workbook by John R. Walker

Safety Hand outs from NJ and PA. Safety Tests

You tube safety videos on Foundry and Forging Safety and Techniques.

Interdisciplinary Connections

MA.K-12.1	Make sense of problems and persevere in solving them.
LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.