

Course: Metal Fabrication
Unit #4: Molding and Forming

Year of Implementation: 2022-2023

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Stage One - Desired Results

Link(s) to New Jersey Student Learning Standards for this course:

<https://www.state.nj.us/education/cccs/2020/>

https://www.nj.gov/education/standards/clicks/Docs/2014_9.3_21LifeAndCareers.pdf

- **Unit Standards:** *(keep each of the following headings in place)*
 - **21st Century Life & Career Standards**
 - 9.3.MN.4 - Describe career opportunities and means to achieve those opportunities in each of the Manufacturing Career Pathways.
 - 9.3.MN.6 - Demonstrate workplace knowledge and skills common to manufacturing.
 - 9.3.MN-PPD.3 - Monitor, promote and maintain a safe and productive workplace using techniques and solutions that ensure safe production of products.
 - 9.3.MN-QA.1 - Evaluate production operations for product and process quality.
 - **English Companion Standards**
 - WHST.9-10.5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
 - **Interdisciplinary Content Standards**
 - RI.9-10.7. Analyze various perspectives as presented in different mediums (e.g., a person's life story in both print and multimedia), determining which details are emphasized in each account.
 - NJSLA.W2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content
- **NJ Statutes:** NJ State law mandates the inclusion of the following topics in lesson design and instruction as aligned to elementary and secondary curriculum.

Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocides in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A. 18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

Diversity and Inclusion (N.J.S.A. 18A:35-4.36a) A board of education shall incorporate instruction on diversity and inclusion in an appropriate place in the curriculum of students in grades kindergarten through 12 as part of the district's implementation of the New Jersey Student Learning Standards.

Asian American and Pacific Islanders (AAPI) P.L.2021, c.410 Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSL) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416)

For additional information, see

NJ Amistad Curriculum: <http://www.njamistadcurriculum.net/>

Diversity and Inclusion: <https://www.nj.gov/education/standards/dei/index.shtml>

- (Sample Activities/ Lessons): <https://www.nj.gov/education/standards/dei/samples/index.shtml>

Asian American and Pacific Islanders:

- [Asian American and Pacific Islander Heritage and History in the U.S.](#)

A Teacher's Guide from EDSITEment offering a collection of lessons and resources for K-12 social studies, literature and arts classrooms that center around the experiences, achievements and perspectives of Asian Americans and Pacific Islanders across U.S. history.

Transfer Goal: Students will be able to independently use their learning to explore the physical and chemical makeup of metals to cast metal forms by pouring liquid metal into molds made of plaster, wax, sand or other materials, and craft metal components and sculptures.

As aligned with LRHSD Long Term Learning Goal(s):

- acquire, integrate, and apply design processes and essential technical skills to solve problems, create products, and improve the quality of life for our local and global community

Enduring Understandings

Students will understand that. . .

EU 1

metals can be shaped, transformed and strengthened through heat treatment, welding and other processing methods.

EU 2

metal casting is a process that can create a 3D metal part.

Essential Questions

EU 1

- How does the welding process change when using different materials?
- In what ways can metallurgy transform metal?
- How can alloying metals change the properties of them?

EU 2

	<ul style="list-style-type: none"> ● How do different forming processes create advantages for melting metal? ● How do various thermal factors affect the casting process when melting metals? ● In what circumstances would alternative methods be used in place of casting procedures?
<p><u>Knowledge</u> Students will know . . .</p> <p><i>EU 1</i></p> <ul style="list-style-type: none"> ● metals can be shaped using hammers, anvils, and mallets. (9.3.MN.6) ● metals can be cut with saws, CNC and wet-jet. (9.3.MN.6) ● the chemistry and atomic structure of metals can be changed. (9.3.MN-PPD.3) ● metals can be joined together by using a variety of welding processes. (9.3.MN.6) ● metallurgy can change the hardness of a material. (9.3.MN-PPD.3) <p><i>EU 2</i></p> <ul style="list-style-type: none"> ● liquids can be poured into molds (9.3.MN-QA.1) ● the type of casting is dependent on the part, size, quantity, tolerance and material (9.3.MN.6) ● a variety of materials can be used to create a cast (9.3.MN.6) 	<p><u>Skills</u> Students will be able to . . .</p> <p><i>EU 1</i></p> <ul style="list-style-type: none"> ● use the appropriate tools to shape metal. (9.3.MN.6) ● use the appropriate separating method. (9.3.MN.6) ● strengthen metals through heat treating, welding and other methods. (9.3.MN-PPD.3) ● use the correct welding process to join metals together (9.3.MN.6) <p><i>EU 2</i></p> <ul style="list-style-type: none"> ● identify the use of expandable, permanent, and composite mold castings. (9.3.MN-QA.1) ● create a cast using the appropriate method, material and forms. (9.3.MN.6) ● compare and contrast the benefits and drawbacks of different casting methods. (9.3.MN.6)

Stage Two - Assessment

Stage Three - Instruction

Learning Plan: Suggested Learning Activities to Include Differentiated Instruction and Interdisciplinary Connections: Each learning activity listed must be accompanied by a learning goal of A= Acquiring basic knowledge and skills, M= Making meaning and/or a T= Transfer. The following color codes are used to notate activities that correspond with interdisciplinary connections and 21st Century Life & Career Connections (which involves Technology Literacy): Red = Interdisciplinary Connection; Purple = 21st Century Life & Career Connection

- Create a 3D part that is fully dimensioned including tolerances (A, EU2)
- Mill a piece of material to size (M, EU1)
- Use the machining tool to drill a hole, bore, or counter sink (M, EU1)
- Test the effect fit of the designed part prior to fabrication (A, M, T, EU1)
- Select an efficient casting method for the given part (A, M,T, EU2)
- Properties of metals and alloys (A, EU2)
- Fabricate the product using a CAM system (M, T, EU1)
- Advantages and disadvantages of different casting methods (A, EU2)
- Safety check and evaluate the part during production and post production (A, T, EU2)
- Finish the piece of material to give it a look that is aesthetically pleasing (M, EU1)
- Group discussion and evaluation of products (T, EU2)
- Peers will evaluate the products based on form and function (M, T, EU2)

Pacing Guide

Unit #	Title of Unit	Approximate # of teaching days
1	Safety	30
2	CAD/CAM	40
3	Machining	70
4	Molding/Forming	40

Instructional Materials

A fully equipped metal shop

Accommodations

Special Education: The curriculum will be modified as per the Individualized Education Plan (IEP). Students will be accommodated based on specific accommodations listed in the IEP.

Students with 504 Plans: Students will be accommodated based on specific accommodations listed in the 504 Plan.

English Language Learners: Students will be accommodated based on individual need and in consultation with the ELL teacher.

Students at Risk of School Failure: Students will be accommodated based on individual need and provided various structural supports through their school.

Gifted and Talented Students: Students will be challenged to enhance their knowledge and skills through acceleration and additional independent research on the subject matter.