



METAL MUSEUM

Lesson: Abraham Darby, the Industrial Revolution and the Foundry

Grade Levels: 9th through 12th Grades

Subjects: Visual Art, History, Social Studies

Activity: Tour of Foundry and Cast Aluminum Scratch Block Workshop

Description:

Students will learn foundry techniques pioneered during the Industrial Revolution, as well as present day practices, through a guided tour of the Metal Museum. Students will also have the opportunity to watch an aluminum pour and to make their own cast aluminum tiles.

Goals:

- 1) Students will learn what life was like in a foundry during the Industrial Revolution and how innovations made within foundries changed architecture and mass production.
- 2) Students will learn the art of casting through hands-on activities and by exploring multiple examples of objects cast by artists. Emphasis will be on reverse read (such as in printmaking), linear and volumetric design and creating high and low relief.

Lesson Objectives:

History and Social Studies

- Students will be able to analyze life before the American Revolution, when most workers were employed on a farm, versus life after the Revolution when workers were employed in factories, noting the impact of new innovations and opportunities.
- Students will be able to discuss what happened after the Civil War, as the Industrial Revolution progressed during the late 19th century, to cause the charcoal industry of Tennessee to decline.
- Students will be able to compare how life changed for the average person due to the Industrial Revolution.
- Students will learn the significant contribution of African Americans that lived on or near pig iron factories.

Visual Arts

- Students will develop the ability to look at a work of art and attempt to interpret what the artist intended for them to see, as well as form their own ideas about what the work of art means to them. Talking about their ideas

helps foster their ability to understand the works of art they will see in the Metal Museum.

- By observing distinct subjects in art, students are able to begin to understand that art has meaning and that artists communicate meaning through their compositions, material choice, and technique.
- Students will design and implement a collaborative piece of artwork, culminating in a permanent mural. (optional)

Tennessee World History Curriculum Suggestion Connections

- **W.7** Explain the connections among natural resources, entrepreneurship, labor and capital in an industrial economy including the reasons why the Industrial Revolution began in England.
- **W.10** Explain how scientific and technological changes and new forms of energy brought about massive social, economic, and cultural demographic changes including the inventions and discoveries of James Watt, Eli Whitney, Henry Bessemer, Louis Pasteur and Thomas Edison.
- **W.11** Analyze the evolution of work and labor including the work of William Wilberforce and the demise of the slave trade, problems caused by harsh working conditions, and the effect of immigration, mining and manufacturing, division of labor, the union movement and the impact of social and political reform.
- **W.12** Participate effectively in collaborative discussion
- Social Studies:
- **US.1** Explain patterns of agricultural and industrial development as they relate to climate, use of natural resources, markets and trade, the growth of major urban areas, and describe the geographic considerations that led to the location of specialized industries such as textiles, automobiles, and steel.
- **US.6** Describe the changes in American life that resulted from the inventions and innovations of business leaders and entrepreneurs of the period.
- **US.7** Analyze the movement of people from rural to urban areas as a result of industrialization.

Tennessee Visual Arts Standards to be taught through this Activity

- **CREATE:** Students will choose and evaluate a range of subject matter, symbols, and ideas.
- **PRESENT:** Students will understand and apply media, techniques, and processes and use knowledge of structures and functions.
- **RESPOND:** Students will understand the visual arts in relation to history and cultures and reflect upon and assess the characteristics and merits of their work and the work of others.
- **CONNECT:** Students will make connections between visual arts and other disciplines.

Classroom preparation prior to visit:

- Review vocabulary
- Suggested discussion with students:
 - What social and technological movements emerged in response to the Industrial Revolution?
 - Prior to the Civil War 14 counties in Tennessee were major players in the iron industry along or in proximity to the Tennessee River. What do you think those communities looked like then and today?
 - As a class, identify objects in the classroom that have been cast. What materials are they made of? Why would they have been cast, instead of made using another process? What characteristics do the cast items share?
 - If you were to cast an artwork, what would it be? What material would you use? Would you want to make just one or multiples?

After your Visit

These are a few suggested activities that you can do in your classroom after your visit to the Metal Museum.

- Reflective Writing Assessment
 - Students can reflect on the scratch block they designed. They should be able to explain the impact of today's technology and environment on their design and what someone in 1880 would think of their piece.
 - Students should be able to reflect on their art piece, their foundry observation and museum visit, and share their experiences.
 - Students will be able to draw parallels between foundries of the 1800s and the foundries of today.
- Social Studies
 - Have students research and learn about Iron Furnaces along the Tennessee Iron Furnace Trail
 - Have students look for specific counties where their ancestors might have settled and investigate if their ancestors were iron workers or worked in areas that supported iron workers.
 - Identify the contributions of free and enslaved African-Americans, as well as that of white men, women and children, to the numerous furnaces and forges in middle Tennessee.
 - Explore how people lived during the 19th century?
 - Identify the causes and effects of The Age of Steel
 - Research Henry Lodge Manufacturing and compare and contrast the production in his foundry to what was seen in the foundry at the Metal Museum

Vocabulary

Foundry Terms

Iron is the second most common metal on Earth, and the most widely-used metal. It is used a lot because it is strong and cheap.

Wrought Iron – Iron that has a low carbon content and easily could be shaped when reheated; often used for fences, gates and decorative pieces.

Cast Iron – Iron which has been melted and poured into a shape.

Ore is a naturally occurring mineral containing a valuable constituent (such as iron) which is mined.

Coke is a type of fuel with few impurities and a high carbon content, usually made from coal. It is the most important raw material fed into the blast furnace.

Furnace - An insulated cylinder fueled by propane gas and forced air to melt metal.

Blast Furnace – A hollow, elongated egg-shaped chamber, supported by a square stone stack in which iron ore was smelted to produce pig iron.

Pig Iron – is the intermediate product of smelting iron ore. It is the molten iron from the blast furnace, which is a large and cylinder-shaped furnace charged with iron ore, coke, and limestone.

Smelting - is a form of extractive metallurgy; its main use is to produce a base metal from its ore. This includes production of silver, iron, copper and other base metals from their ores.

Slag – A liquid mixture of non-ferrous impurities and flux produced during the smelting process that becomes rock hard when cooled. It occurs in many different colors.

Dross - Impurities that float on the surface of molten non-ferrous metal.

Ironworks – A collective name that describes a blast furnace, forge, mill, foundry and/or other specialty metals shop.

Foundry - a factory that produces metal castings. Metals are cast into shapes by melting them into a liquid, pouring the metal in a mold, and removing the mold material or casting after the metal has solidified as it cools.

Aluminum - Aluminum is the second-most used metal after steel, due in part to its versatility and efficiency. Pure aluminum is a silvery-white metal. Aluminum's properties of malleability and corrosion resistance make it ideal for applications such as soda cans. The most abundant metal in the Earth's crust, its melting point is 1,200 degrees Fahrenheit. Aluminum is cast at 1,400 degrees Fahrenheit.

Alloy- A mixture of metals, or a mixture of a metal and other elements.

Crucible - A container made of clay and graphite that can withstand very high temperatures.

Non-ferrous Metal – a metal that does not contain iron in significant amounts. Typically a metal that will not rust when oxidized.

Lifting Tongs - A tool used to transfer the crucible from the furnace to the pouring shank.

Pouring Shank - A foundry tool that secures the crucible to a long rod. This is used to pour the metal into the mold.

Industrial Revolution – People, Architecture and Life in the Foundry

Abraham Darby – Abraham Darby and John Wilkinson built the first *iron bridge* over the Severn River at Coalbrookdale, England in 1779 because of the invention of the steam locomotive and stronger spans were needed.

Crystal Palace – was a cast iron and plate-glass building originally erected in Hyde Park, London England, to house the Great Exhibition of 1851. More than 14,000 exhibitors from around the world gathered in the Palace's 990,000 square feet of exhibition space to display examples of the latest technology developed in the Industrial Revolution.

Factory System - workers and machinery together in one place

Mass production - rapid production of identical objects

Interchangeable parts - identical pieces that could be assembled by unskilled workers

Urbanization - the growth of cities due to movement of people from rural areas to cities

Discrimination - denial of equal rights or equal treatment to certain groups of people

Industrial Revolution - the transformation from an agricultural to an industrial nation

Industrialization - the development of industry on an extensive scale

Rural-to- urban migrations - people are drawn in to cities for opportunities; driven by poverty and hope to do better

Modernization - making modern in appearance or behavior

Working Class - a social class comprising those who do manual labor or work for wages

Working Conditions - the environment of the workplace

Assembly Line - mechanical system in a factory whereby an article is conveyed through sites at which successive operations are performed on it

Specialization - the special line of work you have adopted as your career

Middle Class - the social class between the lower and upper classes

Free Enterprise - an economy that relies chiefly on market forces to allocate goods and resources and to determine prices

Standard of living - a level of material comfort in terms of goods and services available to someone

Urban - relating to or concerned with a city or densely populated area

Human Migration - Movement of humans from one place to another.

Factory - a plant consisting of buildings with facilities for manufacturing

Immigration - migration into a place (especially migration to a country of which you are not a native in order to settle there)

Reform - a change for the better as a result of correcting abuses

Rural - living in or characteristic of farming or country life

Art History and Design

Linear Design - Of or relating to the characteristics of a work of art in which forms and rhythms are defined chiefly in terms of line.

Volumetric Design - Design relating to, or involving the measurement of volume.

Composition - In visual arts, composition is the placement or arrangement of visual elements or ingredients in a work of art.

Variety- combining one or more elements to create interest.

Harmony- blending elements in a pleasing way.

Emphasis- making an element or object in a work stand out.