STEM Careers Coalition™

CLASSROOM ACTIVITY

Manufacturing Design

OBJECTIVE

After exploring the concept of manufacturing, students will follow the design process as they create a prototype of a new product and then investigate a manufacturing career that could help produce it.

MATERIALS

- Manufacturing Word Web squares (cut out in advance), enough sets for half the class
- Design Process handout, enough for half the class
- Manufacturing Careers handout, one per student
- Devices with Internet access, as many as possible or at least enough for half the class

ENGAGE

- Begin by asking the class to find a partner and pass out one set of Manufacturing Word Web squares to each pair.
- Instruct pairs to find the Manufacturing square, read it aloud, and then place it in the center of their desk.
- Explain that the rest of the cards all connect to manufacturing. Challenge pairs to read through each of the remaining squares and then work together to create a web extending from their Manufacturing card. They should think about how the terms and phrases could connect to each other and then place the cards accordingly.
- When most groups are done with their webs, encourage a few groups to share their web structure and explain the reasoning behind it. Note that there is not one correct structure as long as students' reasoning is sound!

TIP!
If needed, you may suggest that pairs begin by placing the Today card on one side of Manufacturing and the Past card on the other side. Students can then look for cards that fit into these two categories as they build their web.

EXPLORE

- Ask: Before a good is manufactured, what do you think must happen? Explain that goods must go through a design process *before* they are manufactured to ensure that the product is of high quality and meets a need in society.
- Tell students to pretend that they now work as Industrial Designers for a cell phone company interested in manufacturing innovative cell phone cases. Distribute a Design Process handout to each pair. Read through the steps provided and explain that Step 1 has already been completed. Then encourage pairs to get started and continue the design process.
- When it seems like most groups have completed Step 5, guide the class in moving on to the final step at the same time.

APPLY

- Pair partners together to form groups of four or six and instruct them to share their cell phone case design ideas with each other.
- Then distribute one Manufacturing Careers handout to each student and read through the directions together. Explain that the websites provided describe overall career responsibilities so students will have to *infer* (or make an educated guess) how the career would connect to the development of their phone case.

  Note: If there are enough devices available for each student to have one, students may complete the handout individually. If not, instruct each partner to choose one career to explore and encourage partners to research the two careers together.
- Wrap up by asking students to share the career they selected for the final question, why this career intrigues them, and the role this career could play in the development of their cell phone case. Encourage students to keep these careers in mind as they look toward their own futures!

OPTIONAL EXTENSION

Students may use free CAD software such as Tinkercad or 3D Slash to build 3D versions of their designs.

MANUFACTURING WORD WEB SQUARES

Instructor note: Cut out squares in advance.

Manufacturing: **The process of turning raw (natural) materials into finished goods or products.**	**Assembly line:** A line of workers, machines, and/or robots in a factory that each perform a particular job before the product moves to the next position in line.
Advanced manufacturing: The innovative processes that are currently used to produce products more efficiently, thanks to advances in science, engineering, and information technologies.	**Industrial Revolution:** The period of time beginning in the 1700s when processes were invented that allowed goods to be produced by machines instead of by hand.
3D printing: Additive manufacturing that uses a 3D printer to build objects layer by layer, based on a 3D computer design.	**Artificial Intelligence (AI):** Robots join humans *and* work independently to maintain manufacturing systems, produce products efficiently, and improve safety.
Before factories existed, most people's lives revolved around farming. Goods were produced by hand in small shops and at home.	**Augmented Reality (AR):** The result from AR glasses and headsets allowing manufacturers to superimpose graphics and audio over real life. AR can show workers how to build specific parts, identify materials, and more. It helps reduce costs, improve worker safety, and increase efficiency.
Today	In the Past
Mass production began. Since goods could be produced more efficiently, prices dropped.	Products are more affordable, detailed, readily available, innovative, and able to solve specific problems.

DESIGN PROCESS

Step 1—Define the problem: Customers have expressed the want and need for cell phone cases that do more than just protect their phones.

Step 2—Research the problem: Develop questions to help you understand what cell phone users would like in a phone case. Then pose these questions to your peers.

Question:

Question:

Question:

Step 3—Brainstorm solutions: Think about your peers' responses and jot ideas for new cell phone cases below.

Step 4—Select a solution: Circle the one cell phone case solution from above that you believe could be manufactured to best meet the needs of cell phone users.

Step 5—Create a prototype: Draw a first draft of your case design in the space below. If you were to use a 3D printer to create a prototype of your design, you would need to recreate your sketch in a 3D modeling program (such as CAD).

Step 6—Evaluate the prototype: Share your design with another group and describe how its design meets the needs of cell phone users. Provide feedback to each other, and then edit your design accordingly.

MANUFACTURING CAREERS

Directions: Below are just a few of the careers that could be involved in the development of your phone case.

Select two careers and visit their websites. As you learn more about each one, consider the role it could play in the manufacturing of your cell phone case. Jot notes in the chart below and then answer the final reflection question.

Career Opportunities:

Industrial engineer: tinyurl.com/y742kjsr

Materials engineer: tinyurl.com/vbrkmsj

Machinist: tinyurl.com/wavpaku

Software developer: tinyurl.com/y9mthgek

Industrial production manager: tinyurl.com/sg6f3xq

Manufacturing executive: tinyurl.com/rmwmxg7

Quality control inspector: tinyurl.com/rwc66zp

Materials mover: tinyurl.com/wwkjymw

Manufacturing sales representative: tinyurl.com/v2bru5k

Career 1:	**Career 2:**
What responsibilities could this career have in the manufacturing of your phone case?	

Reflect: Think about what you have learned about these two careers. Which career interests you more and why?