



CLASSROOM ACTIVITY

Materials Science

OBJECTIVES

During this lesson, students will:

- examine the importance of STEM skills in facing world problems
- analyze the physical properties of materials in their own homes
- design a prototype that repurposes a household material to solve a problem

OVERARCHING QUESTION

How can we use our STEM skills to repurpose materials and develop solutions?

STANDARDS

Next Generation Science Standards

- Engineering Design
 - MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- Matter and Its Interactions
 - PS1.A: Structure and Properties of Matter
 - Disciplinary Core Idea: Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.

Common Core English Language Arts

- Writing:
 - W.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- Speaking and Listening:
 - SL.2: Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

Instructional Note:

The following activity has been designed so you can tailor it to your current mode of instruction.

- The *Introduce*, *View & Reflect*, and *Conclude* sections can be presented virtually, by video, or through a shared document.
- The *Challenge* section is designed for students to complete independently at home using the accompanying *Challenge* handout. Students can either print and fill out the handout or answer the questions separately in a format that can be shared with you.

ACTIVITY OVERVIEW

Introduce

1. Begin by challenging students to brainstorm skills that are essential to success in STEM subjects and careers. Encourage them to think beyond content skills and include skills like problem-solving, creativity, critical thinking, communication, and collaboration. It may be helpful to provide examples of STEM careers—such as doctors, computer programmers, and aerospace engineers.
2. Begin by challenging students to brainstorm skills that are essential to success in STEM subjects and careers. Encourage them to think beyond content skills and include skills like problem-solving, creativity, critical thinking, communication, and collaboration. It may be helpful to provide examples of STEM careers—such as doctors, computer programmers, and aerospace engineers?
3. Explain that students are about to watch a short video that highlights how one company—Boeing—has answered this question.

View & Reflect

1. Before students watch the Boeing Career Profile video, present the following headline: *Boeing applies STEM skills to help with COVID-19.*
2. Tell students that, after watching the video, they will be responsible for writing the first line of this article. This sentence should elaborate on the headline and provide further details on how Boeing employees are applying their STEM skills and knowledge to help deal with the pandemic.
3. Then share the Boeing Career Profile video. Students may find it helpful to view the video more than once!
4. When the video is complete and students have written the article's opening line, encourage them to share their first sentences and reflect on similar key details that they consistently included.

CHALLENGE

1. Explain that the class will now be challenged to emulate Boeing's innovative approach to problem-solving. Each student will take on the role of a materials engineer as they consider how to repurpose materials in their own homes to solve a problem.
2. Share the *Challenge* handout and review the instructions. Remind students that while they may not have a materials engineering background, they do have many other STEM skills that can be transferred to tackle this challenge!

CONCLUDE

1. Once the Challenge activity is complete, invite students to share the innovative ways they repurposed materials in their homes. Encourage them to also consider which STEM skills they utilized and how these skills helped them as they tackled this problem.
2. Wrap up by congratulating students on rising to the challenge and applying their STEM background to help their own families!

Directions: Read the Background section below to prepare for taking on the role of a materials engineer. Then complete Steps 1-4 as you consider how materials in your own home could be repurposed to help your family through COVID-19. Any question with a  requires a written response.

Materials Science Background

Material selection is an important decision when products are designed and produced. There are thousands of different kinds of materials, including variations of wood, plastic, glass, fabrics, alloys (metals mixed with other metals), and composites (mixtures of two different materials). While some materials can be used interchangeably, other materials that are perfect for one product could be disastrous when used for something else!

Materials engineers develop and test materials for new products. They work on the creation of new materials and consider how existing materials can be repurposed (or reused in new and different ways). When analyzing and testing materials, they consider the material's physical and chemical properties.

Physical properties are properties that can be observed and analyzed without changing the material's composition. Color, texture, and density are all examples of physical properties. A material's mechanical properties—or how the material responds to outside forces—also fall into this category. *Chemical properties* are characteristics that can be observed and analyzed when the material undergoes a chemical reaction. Chemical properties are safer to observe in a lab environment.

Step 1—Explore

Take a moment to observe the variety of materials inside your home. Then choose three different materials that your family doesn't use regularly *or* are about to throw away, and fill out the chart below. An example has been completed for you.

Material	What is it used for?	Physical Properties					
		Texture: What does it feel like?	Strength: Will it crack or break?	Rigidity: Can it be bent out of shape?	Ductility: Can it stretch?	Durability: Can it be used again and again?	Other important qualities to note:
Example: Plastic	One-gallon milk carton	Smooth	It will not crack or break easily.	It keeps its shape but can be flexible.	No	Yes	· Transparent · Waterproof

Step 2—Analyze

Just as Boeing worked to repurpose their aviation materials to create face shields, you can also repurpose materials to help your family during COVID-19.

Think about how the materials that you just recorded could be used in a different way to help your family's physical, mental, or social health:

- **Physical health:** Could one of the materials be repurposed to safely increase your family's physical activity or help prevent the spread of germs?
- **Mental health:** Could one of the materials be repurposed to help your family feel calmer or happier?
- **Social health:** Could one of the materials be repurposed to help your family feel connected to others even if they are apart?

 **Step 3—Explain**

1. Which material did you select for repurposing? What is it currently used for, *and* what are its most important physical properties?

2. How could you repurpose this material to help your family's physical, mental, or social health? Be sure to include any changes you may need to make to the material.

 **Step 4—Create**

Create a prototype of your design. You may do one of the following:

- Use the material to build a 3-D model and share a photo of your innovation.
- Sketch a picture of your design. Be sure to label its most important parts!