What Useful Everyday Items Are Created by Combining Plastics and Metal?
Let’s take a fresh look at two previously explored materials: plastic and metals.

Materials
Plastic bucket, metal bucket, plastic silverware, metal silverware, aluminum foil, plastic wrap, plastic measuring cups, metal measuring cups, tin can, plastic container, magnetic tape or button magnets, marker, bottle caps, foam to fill or smaller caps to fit inside larger, scissors, black fine-point marker, colored plastic spoons, googly eyes, chenille sticks, plastic headbands, glue gun.

A more detailed list can be found on Page 2.

Standards
NCECDTL, ELOF: Goal IT-ALT 3, 4, 5, 6, 7, 8, 9; Goal P-ATL 6, 7, 8, 9, 10, 11, 12, 13; Goal P-LC 1, 2, 3, 4, 5, 6, 7; Goal P-LIT 4, 5; Goal IT-C 1, 2, 3, 5, 6, 7, 9, 10, 12, Goal P-MATH 7, 8, 10; Goal P-SCI 1, 2, 4, 5, 6; Goal IT-PMP 1, 2, 3, 4, 5, 6, 7, 8; Goal P-PMP 2, 3; MI Standards SS 1, 3.

Model i Innovation Learning Framework
Throughout this lesson, there will be opportunities to bring in Model i’s Habits of an Innovator and Actions of Innovation.

More information on Model i can be found at: thf.org/education/teaching-innovation/modeli

Lesson Overview

<table>
<thead>
<tr>
<th>STEAM</th>
<th>ELA/LIT</th>
<th>SS/HST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explore</td>
<td>Discover</td>
<td>Create</td>
</tr>
<tr>
<td>Compare and contrast spoon, bucket, metal and plastic wrap. Discuss differences.</td>
<td>Explore the classroom and outside for items made of plastic and metal.</td>
<td>Create refrigerator magnets with bottle caps and magnets, antennae with plastic headbands and chenille sticks, or spiders with chenille sticks and plastic spoons.</td>
</tr>
<tr>
<td>Inspiring Stories</td>
<td>Artifact of the Day</td>
<td>Review &amp; Extend</td>
</tr>
<tr>
<td>Read stories related to the learning: If You Had a Jetpack by Lis! Detlefsen, The Adventures of Wally and Warren: Destination Imagination by Lise Chase, The Most Magnificent Thing by Ashley Spires, or What Do You Do with an Idea? by Kobi Yamada.</td>
<td>Show students pictures of the Dymaxion House. Invite a guest who works as an electrician, or someone who works in the auto or airline industry or related job.</td>
<td>Ask students specific and open-ended questions. Family Connection worksheet to send home. Coloring sheet to send home or work on in class.</td>
</tr>
</tbody>
</table>
Let’s Learn About
PLASTIC & METAL

Materials

Explore

Activity — Touch Exploration
- Plastic and metal objects, such as buckets, measuring cups, aluminum foil/plastic wrap, tin can/see-through plastic container.
- Teachers can provide as many examples of plastic and metal as possible for touch exploration.

Discover

Activity — What Is Made of Plastic and Metal in Our Classroom or Our Playground?
- Light fixtures
- Projector
- Computer
- Wheeled chair
- Play equipment
- Toys
- Desks
- Chairs
- Whiteboards
- 3-ring binder
- Landline telephone
- Playground equipment

Create

Project One — Magnet Faces
- Clean plastic bottle caps (or substitute plastic buttons)
- Googly eyes (small enough to fit two per bottle cap)
- Foam to fill inside of caps, or use another cap to fill the inside
- Scissors or knife to cut foam and trim magnets (if necessary)
- Glue
- Magnetic tape or magnet buttons (found in craft sections or stores)
- Black permanent marker, fine point

Project Two — Spoon Ants
- Plastic spoons, variety of colors, two per ant
- Black chenille sticks, five or six per ant
- Glue gun
- Googly eyes, largest to fit two per ant head

Project Three — Antennae Headbands
- Plastic headbands, child size
- Chenille sticks, sparkle silver
- Glue gun
Let’s Learn About
PLASTIC & METAL
Lesson Guide

Explore
Stay Curious, Collaborate, Uncover
How Versatile Are Plastic and Metal? .......... Page 4
Activity: Touch Exploration .......... Page 4
Links & Photos ..................... Pages 5-10

Discover
Stay Curious, Collaborate, Uncover

Artifact of the Day
Stay Curious, Uncover
Dymaxion .................. Page 12
Link & Photo ................ Page 13

Create
Collaborate, Design, Learn from Failure
What Can We Make with Plastic and Metal?
Project 1: Magnet Faces .......... Page 14
Project 2: Spoon Ants ............ Page 15
Project 3: Antennae Headbands .......... Page 16

Inspiring Stories
Stay Curious, Be Empathetic
Read Stories to Inspire Your Students .......... Page 17

Review & Extend
Stay Curious, Collaborate
Ask Students Specific and Open-Ended Questions .......... Page 18
Family Connection ................. Page 19
Coloring Sheet .................... Page 20

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How Versatile Are Plastic and Metal?

Explore why some useful objects are made of plastic versus metal and others are made with both materials.

Discover what can be created when plastic and metal are combined by looking at some combined objects, including the Edison 2, race cars, the Goldenrod, toy trains, and from around the classroom: toy cars, electrical wire, older telephone, typewriter, light switches, microwave, etc.

Links and photos for this section are on Pages 5-10.

Activity

Touch Exploration

Teachers show students and help students talk about the similarities and differences between plastic and metal objects, such as buckets, measuring cups, aluminum foil/plastic wrap, tin can/see-through plastic container.

Teachers ask students questions such as:

• Which is heavier?
• Why would one work better for the task over the other?
• Both can be rolled into a ball, but which is easier to unroll?

Examples:

<table>
<thead>
<tr>
<th>Plastic spoon</th>
<th>vs</th>
<th>Metal spoon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the job</td>
<td></td>
<td>Does the job</td>
</tr>
<tr>
<td>Cheaper</td>
<td></td>
<td>Heavier</td>
</tr>
<tr>
<td>Disposable</td>
<td></td>
<td>Eco-friendly</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plastic bucket</th>
<th>vs</th>
<th>Metal bucket</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holds water</td>
<td></td>
<td>Holds water</td>
</tr>
<tr>
<td>Lighter</td>
<td></td>
<td>Stronger</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plastic wrap</th>
<th>vs</th>
<th>Aluminum foil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covers food</td>
<td></td>
<td>Covers food</td>
</tr>
<tr>
<td>Clingier</td>
<td></td>
<td>Reusable</td>
</tr>
</tbody>
</table>
Let’s Learn About PLASTIC & METAL INNOVATION

Explore — Links

2010 Edison 2 Concept Car

thf.org/collections-and-research/digital-collections/artifact/364669
Let’s Learn About
PLASTIC & METAL

1987 Ford Thunderbird Stock Car, Raced by Bill Elliott

thf.org/collections-and-research/digital-collections/artifact/126545
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Explore — Links

2011 Ford Fusion Stock Car, Driven by Trevor Bayne

thf.org/collections-and-research/digital-collections/artifact/369621
1965 Goldenrod Land Speed Race Car

thf.org/collections-and-research/digital-collections/artifact/329032

Set wheeled-vehicle land speed record of 409.277 mph, no rocket engines.
Let’s Learn About
PLASTIC & METAL

Explore — Links

Athearn Model “Pennsylvania Railroad” Diesel Locomotive, 1945-1975

thf.org/collections-and-research/digital-collections/artifact/333249
Let’s Learn About

PLASTIC & METAL

Explore — Links

Toy Caboose, 1953
thf.org/collections-and-research/digital-collections/artifact/143991
Activity
What Is Made of Plastic and Metal in Our Classroom?

Students can explore the classroom and outside, weather permitting, to discover which innovative objects can be made when you combine metal and plastic, such as light fixtures, projectors, computer, wheeled chair, playground equipment, etc.

Model i Innovation Learning Framework
Stay Curious, Collaborate, Uncover

- Ask questions like what, why, how.
- Talk about helping, working together.
- What do you see (characteristics, properties)? What problems do these materials help us solve?
What Is the Dymaxion House?

Buckminster Fuller was a multidisciplinary designer. This house, his rethinking of human shelter, was rooted in Fuller’s understanding of industrial production. He was particularly interested in the methods of mass production developed in the automobile industry and especially those advocated by Henry Ford, for whom Fuller had immense admiration. These homes were to be produced by an aircraft company — notice the similarity of the house to an airplane — and intended to be affordable housing that could be set up anywhere. More an engineering solution than a home, the structure was prototyped but never produced.

Additional Presentation

As this lesson deals with plastic and metal, invite a guest who is an electrician, or someone who works in the auto or airline industry or related job.

The link and photo for this section is on Page 13.
Let’s Learn About PLASTIC & METAL

Artifact of the Day — Links

Dymaxion House, 1946

thf.org/collections-and-research/digital-collections/artifact/1012
Let’s Learn About
PLASTIC & METAL
Create — What Can We Make with Plastic and Metal?

Project 1: Magnet Faces
Students can create refrigerator magnets of their own design using magnetic tape or buttons and bottle caps with faces.

Materials
- Clean plastic bottle caps (or substitute plastic buttons)
- Googly eyes (small enough to fit two per bottle cap)
- Foam to fill inside of caps, or use another cap to fill the inside
- Scissors or knife to cut foam and trim magnets (if necessary)
- Glue
- Magnetic tape or magnet buttons (found in craft sections and stores)
- Black permanent marker, fine point

Instructions
1. Cut foam to fill inside of bottle caps, or place one cap inside another to fill, creating two flat sides. (For example, milk jug cap will fit into sports drink cap.)
2. Trim magnets so they are just smaller than bottle cap opening.
3. Glue foam into bottle caps.
4. Put glue on the foam and just inside edge of bottle cap and attach magnet.
5. Glue googly eyes on cap top.
6. Use permanent marker to draw mouth and eyebrows on the magnet face.

Model i Innovation Learning Framework
Collaborate, Design, Learn from Failure
- Talk about helping, working together.
- Make, build and create.
- Talk about “trying again,” what’s another way to...

Create — What Can We Make with Plastic and Metal?
Let’s Learn About
PLASTIC & METAL
Create — What Can We Make with Plastic and Metal?

**Project 2: Spoon Ants**
Students can make spoon ants with plastic spoons and pipe cleaners (chenille sticks).

**Materials**
- Plastic spoons, variety of colors, two per ant
- Black chenille sticks, five or six per ant
- Glue gun
- Googly eyes, largest to fit two per ant head

**Instructions**
1. Using glue gun, flip two spoons over and glue together, one handle on top of the other, with spoon bowls on opposite ends, forming ant body base.
2. Wrap two or three black chenille sticks around the handles of the spoons to cover the ant body.
3. Glue googly eyes on the back of one spoon bowl, creating the head.
4. Wrap three black chenille sticks once around the handles at intervals, and bend to create the joints of the legs. (Option: Use glue gun to attach legs if necessary to have enough chenille stick left for leg.)

**Model i Innovation Learning Framework**
**Collaborate, Design, Learn from Failure**
- Talk about helping, working together.
- Make, build and create.
- Talk about “trying again,” what’s another way to...

[Image of spoon ants]
Project 3: Antennae Headbands

Students can make antennae headbands with plastic headbands and pipe cleaners (chenille sticks).

Materials

- Plastic headbands, child size
- Chenille sticks
- Glue gun

Instructions

1. Using hot glue gun, glue one chenille stick to each headband.
2. Give students 1-2 additional chenille sticks to create their antennae by twisting one end of the stick around the headband at the end of the glued stick.
3. Twist the opposite end of the stick into a loop, zigzag or curl to represent antennae.

Model i Innovation Learning Framework

Collaborate, Design, Learn from Failure

- Talk about helping, working together.
- Make, build and create.
- Talk about “trying again,” what’s another way to...

Create — What Can We Make with Plastic and Metal?
Let’s Learn About PLASTIC & METAL

Inspiring Stories

Read Stories to Inspire Your Students

If You Had a Jetpack by Lisl Detlefsen

What Do You Do with an Idea? by Kobi Yamada

The Adventures of Wally and Warren: Destination Imagination by Lise Chase

The Most Magnificent Thing by Ashley Spires

Model i Innovation Learning Framework

Stay Curious, Be Empathetic

- Ask questions like what, why, how.
- How did the characters in the stories feel? How might the stories make others feel?
Let’s Learn About
PLASTIC & METAL

Review & Extend

Ask Students Specific and Open-Ended Questions

• What was the best part of the story?
• What other things do you think are made with plastic and metal?
• What (other) jobs do people do where they might use plastic and metal?

Model i Innovation Learning Framework

Stay Curious, Collaborate

• Ask questions like what, why, how.
• Talk about helping, working together.

Family Connection

Send the worksheet on Page 19 home with students to be completed at the end of the lesson.

Coloring Sheet

Have students color the picture on Page 20 as a part of the lesson, or send it home to be colored.
Take the Learning Home

We are learning about plastic and metal and the way it is used in many items we use every day.

Please take your student on a Scavenger Hunt through your home to see what plastic and metal items you have. Continue the adventure by finding out which parts of an automobile are plastic and which are metal.

Have them draw what they find.

These are some stories related to our learning. You might enjoy reading them with your student.

- Cars and Trucks and Things That Go by Richard Scarry
- If I Built a Car by Chris Van Dusen
- The Dreamer by Il Sung Na
Dymaxion House, 1946