**Let’s Learn About METALS**

**Quick View**

**What Everyday Items Do We Make with Metal?**

Many kinds of metals are found deep in the ground around us. Nuts and bolts, cans, and pots and pans are just a few items made of metal that we use every day. Metal can be used in many ways for work and for play.

**Materials**

Magnets, nuts, bolts, paper clips, copper, tin, iron pipe, nickel, brass, aluminum foil, coins, building bricks, rulers, pencils, erasers, nails, paper binders, scissors, books, tin cans, metal washers, wing nuts, duct tape and pipe cleaners.

* 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**

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<td>Explain metals come from the ground.</td>
<td>Discover which metals are attracted to magnets and which are not through a worksheet.</td>
<td>Make individual or classroom tin can robots.</td>
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<td>Show metalworking at Tin Shop and A&amp;S Machine Shop to show different uses for different metals.</td>
<td>Create aluminum foil sculptures.</td>
<td>Design pipe cleaner crowns.</td>
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<td>Provide many examples of metals for touch exploration.</td>
<td>Design pipe cleaner robots.</td>
<td>Make individual or classroom tin can robots.</td>
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Let’s Learn About METALS

Explore
Activity: Touch Exploration
- Tin
- Copper
- Iron pipe
- Nuts
- Bolts
- Teachers can provide as many examples of metals as possible for touch exploration

Discover
Activity Sheet
- Magnets
- Paper clips
- Coins
- Building bricks
- Rulers
- Pencils
- Erasers
- Nails
- Paper binders
- Scissors
- Books

Create
Project 1: Tin Can Robot
- Tin cans
- Metal washer (1 per can)
- Wing nuts (2 per can)
- Nuts (2 per can)
- 1-inch bolt (1 per can)
- Round magnets (6 per can)
- Duct tape
- Metal pot scrubbers (optional)

Create
Project 2: Aluminum Foil Sculptures
- Aluminum foil
- Pipe cleaners
- Scissors
- Tape

Create
Project 3: Pipe Cleaner Crowns
- Pipe cleaners
Let’s Learn About METALS

Lesson Guide

Explore

Stay Curious, Collaborate

What Is Metal?
Are All Metals the Same? ....... Page 4
Activity: Touch Exploration ....... Page 4
Links & Photos ...................... Pages 5-8

Artifact of the Day

Stay Curious, Uncover

DT&M Roundhouse and Railroad Turntable ............... Page 9
Links & Photos ...................... Pages 10-11

Discover

Stay Curious, Collaborate, Uncover

Why Do Magnets Attract Metals?
Why Do Magnets Only Stick to Certain Metals? ............ Page 12
Activity Sheet ........................ Page 13

Create

Design, Uncover, Learn from Failure

What Can You Make with Metal?
Project 1: Tin Can Robot .......... Page 14
Project 2: Aluminum Foil Sculptures .......... Page 15
Project 3: Pipe Cleaner Crowns ............... 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
Let’s Learn About METALS

What Is Metal?
Teachers should start this lesson by briefly explaining to students that metal comes from the ground and can have very different properties depending on the type of metal.

Types of Metals:
- Aluminum
- Brass
- Bronze
- Copper
- Gold
- Iron
- Silver
- Steel
- Tin

Explain that metals have different properties. Some metals are conductive, like copper, while others can be used in fireworks to create colored sparks. Metals can also be hard or soft, which can be very useful.

Are All Metals the Same?
This section of the lesson focuses on the difference between hard and soft metals.

Give examples of how metal is used in everyday life, and then transition to talking about how metal has been important throughout history by pulling up images of the Tin Shop and Armington & Sims Machine Shop from the collections of The Henry Ford.

Explain to students how people work with different kinds of metal. The Tin Shop works with soft metals. The Machine Shop works with hard metals.

Activity

Touch Exploration
- When talking about the Tin Shop and soft metals, give the students tin and copper to see how some metals are soft and bendable.
- When talking about the Machine Shop and hard metals, they could feel iron pipe and nuts and bolts.

Teachers can provide as many examples of metals as possible for touch exploration.

Links and photos for this section are on Pages 5-8.

Model i Innovation Learning Framework
Stay Curious, Collaborate
- Ask questions like what, why, how.
- Talk about helping, working together.
Let’s Learn About METALS

Explore — Links

Printing Office & Tin Shop, 1933

Additional Resources
Printing Office & Tin Shop Exterior
thf.org/collections-and-research/digital-collections/artifact/11175/
Let’s Learn About METALS

Explore — Links

McKinley-Roosevelt Tin "Dinner Pail" Candle Lantern, 1900
thf.org/collections-and-research/digital-collections/artifact/6619
Let’s Learn About METALS

Explore — Links

Tinsmiths with Their Work Tools, circa 1875
thf.org/collections-and-research/digital-collections/artifact/296848
Let’s Learn About METALS

Armington & Sims Machine Shop, 1930

Additional Resources
Armington & Sims Machine Shop, circa 1889-1929
thf.org/collections-and-research/digital-collections/artifact/388780

Armington & Sims Machine Shop Exterior
thf.org/collections-and-research/digital-collections/artifact/199750
Let’s Learn About METALS

Artifact of the Day

Establish Context
Teachers can show students the DT&M Roundhouse and Railroad Turntable from the collections of The Henry Ford. The turntable is mainly constructed of metal, which students should be made aware of by pointing out the areas in photographs.

Students may be familiar with a roundhouse from Thomas the Tank Engine, so they may be able to tell teachers what the purpose of a turntable is and what a roundhouse does.

What Are the DT&M Roundhouse and Railroad Turntable?
Teachers can show students the DT&M Roundhouse and the Railroad Turntable from the collections of The Henry Ford.

The amazing metal turntable allowed railroad engines to be turned easily so the front of the locomotive was always pointed in the right direction.

The turntable also allows engines to be moved into the roundhouse and then return to work when repairs are done.

Additional Presentation
Teachers may want to invite a guest who works with metals, fabrication or the railroad to share their expertise with students.

Links and photos for this section are on Pages 10-11.

Model i Innovation Learning Framework

Stay Curious, Uncover

• Ask questions like what, why, how.
• What do you see (characteristics, properties)? What problems does this material help us solve?
Let’s Learn About
METALS

Artifact of the Day — Links

DT&M Roundhouse & Railroad Turntable, 1901
thf.org/collections-and-research/digital-collections/artifact/175884
Let’s Learn About METALS

Artifact of the Day — Links

DT&M Roundhouse & Railroad Turntable, 1901
The Henry Ford’s Innovation Nation
Approx. 4 minutes
youtube.com/watch?v=qFPH2KK3ijI
Activity
Have students complete the activity sheet on Page 13 before discussing the following questions.

Why Do Magnets Attract Metal?
Next discuss why magnets might attract metal.

Why Do Magnets Only Stick to Certain Metals?
Magnets attach to strong metals, like iron, nickel and alloys like steel but not to weak metals like brass, copper or aluminum.

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 does this material help us solve?
Are the Objects Magnetic?

Circle or color the objects to show which are magnetic.
Project 1: Tin Can Robot

Materials
- Tin cans — soup size or larger
- Metal washers (1 per can)
- Wing nuts (2 per can)
- Nuts (2 per can)
- Bolt — 1 inch (1 per can)
- Round magnets (6 per can)
- Duct tape
- Metal pot scrubbers

Instructions
1. Use duct tape to cover the rim of the tin cans to seal any sharp edges before giving to students.
2. Attach metal washer as the mouth with magnet.
3. Attach bolt as the nose with magnet.
4. Attach wing nuts as ears with magnet.
5. Attach nuts as eyes with magnet.
6. Optional: Use metal pot scrubbers or other materials to add elements.

Model i Innovation Learning Framework

Learn from Failure, Design, Uncover
- Talk about “trying again,” what’s another way to...
- Make, build and create.
- What do you see (characteristics, properties)? What problems does this material help us solve?

Create — What Can You Make with Metal?
Let’s Learn About METALS

Create — What Can You Make with Metal?

Project 2: Aluminum Foil Sculptures

Materials

- Aluminum foil
- Pipe cleaners
- Scissors
- Tape

Instructions

2. Wrap around a pipe cleaner to provide structure and support.
3. Fold strips over each other to create an object of your choice.
4. Use tape when necessary.

Model i Innovation Learning Framework

Learn from Failure, Design, Uncover

- Talk about “trying again,” what’s another way to...
- Make, build and create.
- What do you see (characteristics, properties)? What problems does this material help us solve?

Create — What Can You Make with Metal?
Let’s Learn About METALS

Create — What Can You Make with Metal?

Project 3: Pipe Cleaner Crown

Materials

- Pipe cleaners (6-10)

Instructions

1. Twist the ends of 2 pipe cleaners together to make the crown base. To adjust to the size of the child’s head, overlap the other 2 ends of the sticks and twist together.

2. Bend the remaining pipe cleaners to create triangles.

3. Wrap the end of one triangle stick around the crown base, and twist the base through the low point of each triangle. Wrap the remaining end of the triangle stick around the crown base to attach.

4. Repeat step 3 with the other triangles.

Model i Innovation Learning Framework

Learn from Failure, Design, Uncover

- Talk about “trying again,” what’s another way to...
- Make, build and create.
- What do you see (characteristics, properties)? What problems does this material help us solve?

Create — What Can You Make with Metal?
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Inspiring Stories

Read Stories to Inspire Your Students

What Makes a Magnet?
by Franklyn M. Branley

What Do You Do with a Problem?
by Kobi Yamada

If I Built a Car
by Chris Van Dusen

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 it make others feel?
Let’s Learn About METALS

Review & Extend

Ask Students Specific and Open-Ended Questions

• What other things do you think might be made with metal?
• What would you make with metal?
• What happened in the story today?

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.
Let’s Learn About METALS

Take the Learning Home

We are learning about metals because they are used in many items we use every day.

Please take your student on a scavenger hunt through your home and neighborhood to see what metal items you can find. What are some of these things? Have them draw what they find.

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

-Metal Man by Aaron Reynolds
-The Most Magnificent Thing by Ashley Spires
-Robots, Robots, Everywhere! by Sue Fliess
Let’s Learn About METALS

Coloring Sheet

DT&M Roundhouse and Railroad Turntable