

Lesson 2: Introduction to Metals

□ Getting Started

Elements on the periodic table fall into one of three categories: metals, metalloids, or nonmetals. Over the next two days, you will learn about metals. Metal atoms tend to line up and stick closely together, which gives many metals properties that are very different from metalloids and nonmetals. The majority of the elements on the periodic table are classified as metals. These include familiar metals like gold and silver as well as some elements you probably don't think of as metals, like potassium and calcium.

Stuff You Need

- ✓ *Fizz, Bubble, and Flash!* by Anita Brandolini, Ph.D.
- ✓ blank paper
- ✓ copper strip (kit)
- ✓ glass or plastic cup
- ✓ iron strips (kit)
- ✓ neodymium magnet (kit)
- ✓ permanent marker* (Activity 3 - optional)
- ✓ scissors* (Activity 4 - Option 1)
- ✓ water and ice
- ✓ aluminum strip (kit)
- ✓ colored pencils
- ✓ dollar bill
- ✓ glue* (Activity 4 - Option 1)
- ✓ magazines or catalogs* (Activity 4 - Option 1)
- ✓ periodic table of elements
- ✓ protective gloves
- ✓ solid antiperspirant

Ideas to Think About

- What properties do most metals have in common?
- Why do metals have these properties?

Things to Know

- **Metals** are elements whose atoms tend to line up and stick closely together. Many metals have luster (after they have been processed and cleaned), are malleable, and are good conductors of heat and electricity.
- If a material is shiny, can reflect light, and be polished, it has the quality of **luster**.
- If a material can be shaped or formed without breaking, it is described as being **malleable**. A material that is not malleable is described as brittle.

- There are 6 categories of metals — the familiar transition metals and main-group metals; the less-familiar alkali metals, alkaline earth metals, and lanthanides; and the man-made and short-lived actinides.

Reading and Questions

Watch the video for an overview of the three element categories (metals, nonmetals, and metalloids). Then read about main-group, transition, and lanthanide metals on pages 31, 40, 83, 100-102, and 116 of *Fizz, Bubble, and Flash!* Answer the questions.

Web Link:

<https://www.movingbeyondthepage.com/link/10054/>

1. What are the three main categories of elements on the periodic table?

2. What are some properties of the main-group, transition, and lanthanide metals?

3. Name some main-group metals and transition metals that you can see from where you are sitting.

4. Name 3 familiar metals that belong to the transition metals category.

Activities

Activity 1: What's a Metal?

In your science kit, you have three metal strips — one of copper, one of aluminum, and one of iron. **CAUTION:** Be sure to wear protective gloves when handling the metal strips since the edges may be sharp.

Use the "Investigating Three Metals" activity pages to explore how the three metals are similar to and different from one another. Locate each one on the periodic table and write down what family it is in. (A full-color periodic table of elements has been included with this unit, and one is available on p. 10 of the book as well.)

You will explore the metals closely and make notes on the activity page. You will be looking at the following categories:

- Color: metals are usually gray, yellow, or orange
- Luster: if a metal is shiny, can reflect light, and be polished, it has the quality of **luster**
- Heaviness: does the metal feel heavy or light?
- Malleability: if you bend or change the metal's shape without it breaking, it has the quality of **malleability**
- Magnetic: if it is attracted to a magnet, the metal is magnetic

After you have observed and taken notes about each metal, fill in the Venn diagram to show the similarities and differences among the three metals.

Activity 2: Neodymium Demonstration

The magnet included in your kit is made primarily from a lanthanide metal called neodymium (combined with some iron and boron, and coated on the outside with nickel). Read about neodymium on page 107 and then follow the instructions for the demonstration on page 108. When you are done, read the information on page 109.

Reading and Questions

Read about alkali, alkaline earth, and actinide metals on pages 12, 21-22, 30, 117, 121 c *Fizz, Bubble, and Flash!* Answer the following questions:

1. Why are you unlikely to find alkali metals or alkaline earths on their own in nature c made into objects like spoons?

2. How long do most actinides last?

3. Find the elements aluminum, iron, sodium, and calcium — which are the most common metal elements on Earth — on the periodic table on page 10. Is one family of metals most common?

Activity 3: Zirconium Demonstration

Read about the transition metal zirconium on page 91, and then follow the directions on the "Zirconium Demonstration" page. NOTE: Be sure that you use solid antiperspirant for this demonstration. The product should have an ingredient with "zirconium" in it.

When you are done with the demonstration, read page 93 in the book.

Activity 4: About a Metal

In this activity, you will choose a metal to learn more about and then either create a collage about the element (Option 1) or create an informational poster about it (Option 2). Choose a metal from the following list and use the page number provided to read more about it in the book. You can also use the following website to learn more.

- lead (page 32)

- bismuth (page 36)
- copper (page 88)
- lanthanum (page 103)
- terbium (page 114)

Interactive Periodic Table

www.movingbeyondthepage.com/link/9249/

Scroll down the page and click the element you want to learn more about.

Option 1: Collage

For this option, you will find and/or draw pictures of the metal as well as products that use your metal. Arrange your drawings or magazine images, and glue them into a collage, listing the element's name at the top of the page. Be sure to include information such as the element's symbol and the metal group it belongs to.

Option 2: Informational Poster

Create a poster on plain paper that provides the following information about the element you chose:

- Its name, symbol, and atomic number
- What group of metals it belongs to
- Characteristics (like color, texture, malleability, heaviness, etc.)
- How it's used
- Interesting and important facts about the element

You can optionally add color, images, or drawings to your poster.

Activity 5: Metals, Metalloids, and Nonmetals

Locate the "Metals, Metalloids, and Nonmetals" activity page. You will be completing this page over the next several lessons. When it is finished, you will be able to easily compare common characteristics of these three major element groups. Use what you have learned in this lesson, as well as in the following video starting around 0:30 (you watched this video yesterday), to fill out the "Metals" column. NOTE: Skip the last two properties (about states of matter and magnetism) for now. They will be covered in later lessons.

Metals, Nonmetals, and Metalloids

www.movingbeyondthepage.com/link/10449/

Wrapping Up

Even though there are several categories of metals, many share common characteristics, such as luster, malleability, and the ability to conduct heat. In the next lesson you'll learn about the small category of metalloids.

Life Application

If it is possible to visit a jewelry-making shop or other metal-working facility, talk to a parent about touring it. Ask the metal workers what metals they use and how hot their tools have to be to work with those metals.

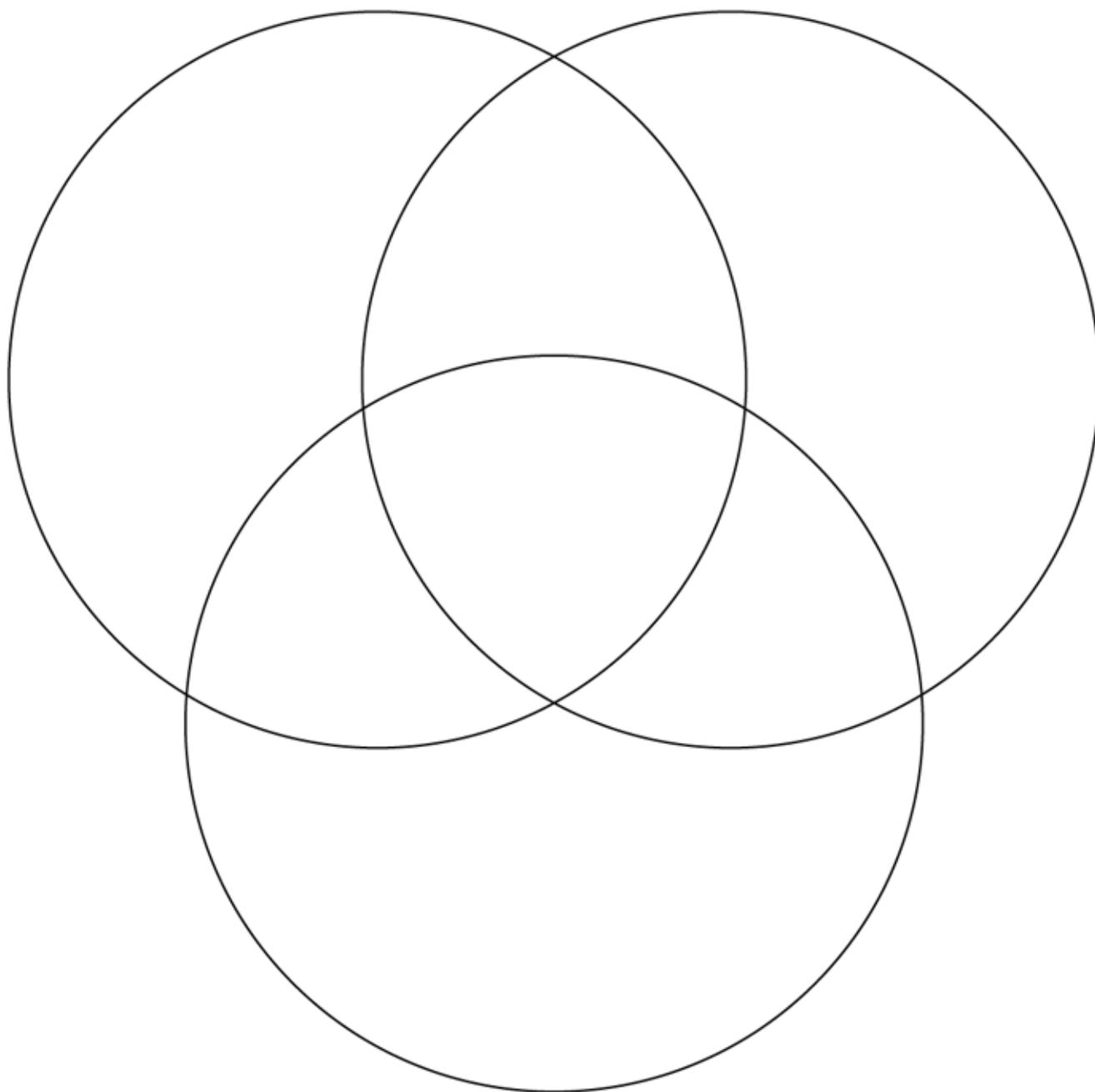
Investigating Three METALS

Directions: Record the family of metals that each metal belongs to. Next, follow these steps to test each metal strip, and record your results in the chart.

1. What color is the metal?
2. Does the metal have luster (is it shiny/can it reflect light)?
3. Be sure you're wearing protective gloves. Pick up the strip and see how heavy it feels. Is it heavy or light?
4. Put the strip of metal into hot water to warm it, and remove it wearing protective gloves. Is the strip malleable (can you bend the strip or change its shape)?
5. Hold up the magnet and see if the metal is attracted to it. Is the metal magnetic?

	Aluminum	Copper	Iron
Family of metals			
Color			
Luster?			
Heavy or light?			
Malleable?			
Magnetic?			

Directions: Label each circle with the name of a metal and the family it belongs to. Use the data you collected to fill in the Venn diagram.



Zirconium Demonstration

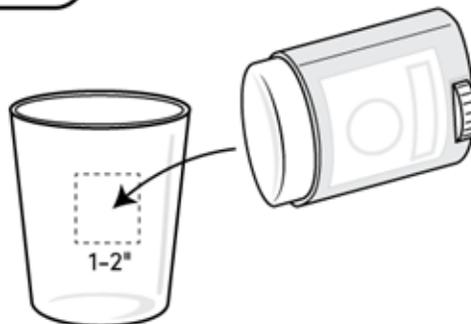


Materials:

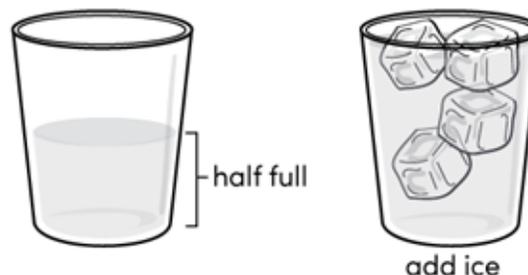
- solid antiperspirant
- water and ice
- glass or plastic cup
- permanent marker (optional)

Procedure:

1. Rub the antiperspirant into a square spot 1-2" in diameter on the outside of a glass or plastic cup, preferably about halfway down the side. (If you are using a disposable plastic cup, outline the square with a permanent marker to make it more obvious.)



2. Fill the glass half full of cold water and then add ice until the water almost reaches the top of the glass.



3. Set the glass of ice water out in a warm room for 5-10 minutes or until water has condensed on the outside of the glass.
4. Look carefully at the outside of the glass, particularly the square where you placed the antiperspirant. What do you notice?

Metals, Metalloids, and Nonmetals

Directions: Metals, metalloids, and nonmetals have fairly distinct properties. You will complete this chart over several days, focusing on one property or category of elements each day. For each property, circle the word or phrase that best describes most of the elements in that category.

Metals	Metalloids	Nonmetals
Luster: SHINY DULL	Luster: SHINY DULL	Luster: SHINY DULL
Malleability: MALLEABLE BRITTLE	Malleability: MALLEABLE BRITTLE	Malleability: MALLEABLE BRITTLE
Conduct heat: WELL SLIGHTLY NOT VERY WELL	Conduct heat: WELL SLIGHTLY NOT VERY WELL	Conduct heat: WELL SLIGHTLY NOT VERY WELL
Conduct electricity: WELL SLIGHTLY NOT AT ALL	Conduct electricity: WELL SLIGHTLY NOT AT ALL	Conduct electricity: WELL SLIGHTLY NOT AT ALL
State of matter at room temperature: SOLID SOLID OR GAS	State of matter at room temperature: SOLID SOLID OR GAS	State of matter at room temperature: SOLID SOLID OR GAS
Magnetism at room temperature: PARAMAGNETIC DIAMAGNETIC	Magnetism at room temperature: PARAMAGNETIC DIAMAGNETIC	Magnetism at room temperature: PARAMAGNETIC DIAMAGNETIC

Parent Overview

Lesson 2: Introduction to Metals

Getting Started

? Big Ideas

- What properties do most metals have in common?
- Why do metals have these properties?



Facts and Definitions

- **Metals** are elements whose atoms tend to line up and stick closely together. Many metals have luster (after they have been processed and cleaned), are malleable, and are good conductors of heat and electricity.
- If a material is shiny, can reflect light, and be polished, it has the quality of **luster**.
- If a material can be shaped or formed without breaking, it is described as being **malleable**. A material that is not malleable is described as brittle.
- There are 6 categories of metals — the familiar transition metals and main-group metals; the less-familiar alkali metals, alkaline earth metals, and lanthanides; and the man-made and short-lived actinides.

⦿ Skills

- Understand the difference between elements and compounds based on observation, description of physical properties, and chemical reactions. Elements are represented by chemical symbols, while compounds are represented by chemical formulas. (S)
- Classify matter based on physical properties including mass. (S)
- Understand that elements are classified as metals, nonmetals, and metalloids based on their physical properties. The elements are divided into three groups on the periodic table. (S)

Introducing the Lesson

Ask your child what he already knows about metals. In this lesson, he will explore some common properties of metals.

Reading and Questions (Answers)

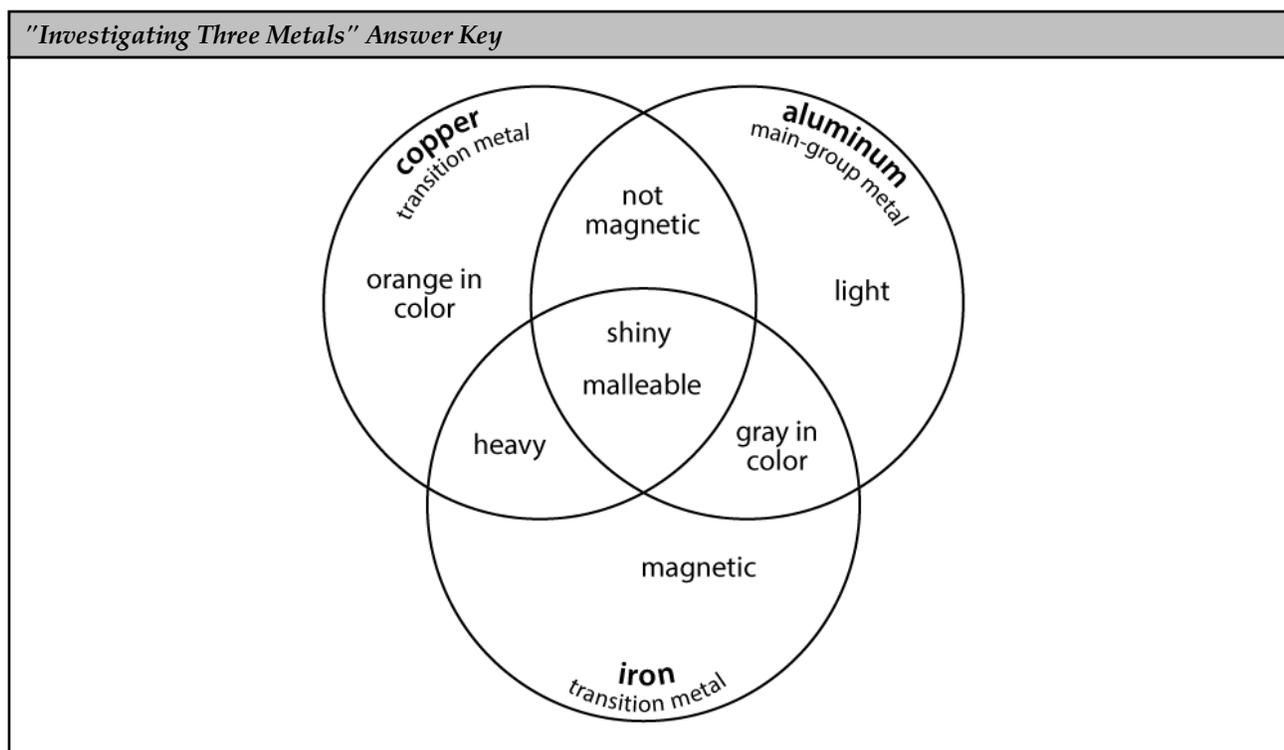
1. What are the three main categories of elements on the periodic table?
 - Metals, metalloids, and nonmetals.
2. What are some properties of the main-group, transition, and lanthanide metals?
 - Shiny, conduct heat and electricity, strong, heavy, solid.
3. Name some main-group metals and transition metals that you can see from where you are sitting.
 - Answers will vary.
4. Name 3 familiar metals that belong to the transition metals category.
 - Answers will vary but may include silver, copper, zinc, gold, iron, nickel, platinum, or mercury.

Outline of Activities and Answer Keys

Activity 1: What's a Metal?

On the "Investigating Three Metals" activity pages your child will explore metal strips made of aluminum, copper, and iron. CAUTION: Be sure that your child wears protective gloves when handling the metal strips since the edges may be sharp. In addition to observing the three strips and testing for magnetism, he will need to put on gloves, dip each strip into a glass of hot water for a minute or so, and then try to bend each strip. Make sure that he is careful with the metal strips

and the hot water. Observe and assist him as needed. Then he will complete a diagram comparing the 3 metals. Note that his answers may vary slightly from the answer key depending on whether he considers iron and copper to be heavy or light, and which metals he considers to be malleable.



Your child should have filled out part of the first column of the "Metals, Metalloids, and Nonmetals" page. He will fill out the rest of the column (and the other columns) in future lessons. Encourage him to hold onto the page. In the Metals column, your child should have circled the following:

Activity 2: Neodymium Demonstration

Reading and Questions (Answers)

- Why are you unlikely to find alkali metals or alkaline earths on their own in nature or made into objects like spoons?
 - Because they react with oxygen in air or water and don't exist long on Earth as pure elements (they like to combine with other elements and form compounds).
- How long do most actinides last?
 - Seconds or less. Most are created by scientists in laboratories.
- Find the elements aluminum, iron, sodium, and calcium – which are the most common metal elements on Earth – on the periodic table on page 10. Is one family of metals most common?
 - No, there is one element from each of four metal families: alkali metals, alkaline earth metals, transition metals, and main-group metals.

Activity 3: Zirconium Demonstration

Your child will do a demonstration to learn more about the element zirconium. The activity requires solid antiperspirant that contains an ingredient that includes "zirconium" in it. Liquid or gel antiperspirants may not contain zirconium. Your child should find that the water condenses on the glass but not on the spot with the antiperspirant on it. When he has finished the demonstration, he should read page 93 in the book for an explanation.

Activity 4: About a Metal

Your child will choose a metal from the list provided and then read about it in the book and online. Then he should create a collage of images of the metal and products that use the metal (Option 1) or create an informational poster about the metal (Option 2).

Option 1: Collage

Your child will create a collage using drawings and/or magazine images of the metal and products that use it. His collage should also include basic information about the metal, including its symbol.

Option 2: Informational Poster

For this option, your child will create an informational poster about the element he chose. The poster should include the element's name, symbol, atomic number, and metal group as well as some of its characteristics, how it's used, and important and interesting facts about it. Your child can optionally include images or color to the poster.

Activity 5: Metals, Metalloids, and Nonmetals

Your child should have filled out part of the first column of the "Metals, Metalloids, and Nonmetals" page. He will fill out the rest of the column (and the other columns) in future lessons. Encourage him to hold onto the page. In the Metals column, your child should have circled the following:

- Luster: shiny
- Malleability: malleable
- Conduct heat: well
- Conduct electricity: well

Wrapping Up

Questions to Discuss

- What metals do you frequently encounter in your daily life? (Answers will vary.)
- Which metal(s) did you find most interesting? Why? (Answers will vary.)

Things to Review

Review the common characteristics of most metals as well as the definitions of *luster* and *malleable*.