

The Periodic Table

Metals

..... Before You Read


What do you think? Read the two statements below and decide whether you agree or disagree with them. Place an A in the Before column if you agree with the statement or a D if you disagree. After you've read this lesson, reread the statements to see if you have changed your mind.

Before	Statement	After
	3. Fewer than half of the elements are metals.	
	4. Metals are usually good conductors of electricity.	

..... Read to Learn

What is a metal?

Metals are some of the most useful elements. Forks, knives, copper wire, aluminum foil, gold jewelry, and many other things are made of metal.

Most of the elements on the periodic table are metals. Except for hydrogen, all of the elements in groups 1–12 on the periodic table are metals. Some of the elements in groups 13–15 are metals also. To be a metal, an element must have certain properties. 

Physical Properties of Metals

Recall that physical properties are characteristics used to describe or identify something without changing its makeup. All metals share certain physical properties. A **metal** is an element that is generally shiny. It is easily pulled into wires or hammered into thin sheets. A metal is a good conductor of electricity and thermal energy. Gold exhibits the properties of metal.

Luster and Conductivity People use gold for jewelry because of its beautiful color and metallic luster. **Luster** is the ability of a metal to reflect light. Gold is also a good conductor of thermal energy and electricity. However, gold is too expensive to use in normal electrical wires or metal cookware. Copper is often used instead.

Key Concepts

- What elements are metals?
- What are the properties of metals?

Mark the Text

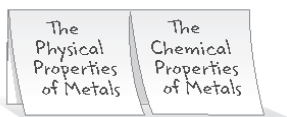
Underline Main Ideas As you read, underline the main ideas under each heading. After you finish reading, review the main ideas that you have underlined.

Key Concept Check

1. Explain How does the position of an element on the periodic table allow you to determine if the element is a metal?

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Make a two-tab book to record information about the physical and chemical properties of metals.



Key Concept Check

2. Identify What are some physical properties of metals?

Visual Check

3. Identify What part of the periodic table is represented by the figure at right?

Ductility and Malleability Gold is the most ductile metal. **Ductility** (duk TIH luh tee) is the ability of a substance to be pulled into thin wires. A piece of gold with a mass the same as that of a paper clip can be pulled into a wire that is more than 3 km long.

Malleability (ma lee uh BIH luh tee) is the ability of a substance to be hammered or rolled into sheets. Gold is so malleable that it can be hammered into thin sheets. A pile of a million thin sheets of gold would be only as high as a coffee mug.

Other Physical Properties of Metals Metals have other physical properties. The density, strength, boiling point, and melting point of a metal are greater than those of other elements. Except for mercury, all metals are solid at room temperature. Many uses of a metal are determined by the metal's physical properties.

Chemical Properties of Metals

Recall that a chemical property is the ability or inability of a substance to change into one or more new substances. Most metals share similar physical properties. The chemical properties of metals, however, can vary greatly. Metals in the same group on the periodic table usually have similar chemical properties. The likelihood that one element will react with another is a chemical property.

Group 1: Alkali Metals

The elements in group 1 are called **alkali** (AL kuh li) **metals**. Group 1 elements are shown on the right. They include lithium, sodium, potassium, rubidium, cesium, and francium.

Because they are in the same group, alkali metals have similar chemical properties. Alkali metals are very reactive. Because they react quickly with other elements, alkali metals occur only in compounds in nature. Pure alkali metals must be stored so that they do not come into contact with oxygen and water vapor in the air. Alkali metals react violently with water. Alkali metals also have similar physical properties. Pure alkali metals have a silvery appearance and are soft enough to be cut with a knife. They also have the lowest densities of all metals. A block of pure sodium metal could float on water because of its very low density.

Lithium 3 Li 6.94
Sodium 11 Na 22.99
Potassium 19 K 39.10
Rubidium 37 Rb 85.47
Cesium 55 Cs 132.91
Francium 87 Fr (223)

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Group 2: Alkaline Earth Metals

The elements in group 2 are called **alkaline** (AL kuh lun) **earth metals**. Group 2 elements are shown on the right. They include beryllium, magnesium, calcium, strontium, barium, and radium.

Like alkali metals, alkaline earth metals react quickly with other elements. But they do not react as quickly as alkali metals do. Like alkali metals, pure alkaline earth metals do not occur naturally. They combine with other elements and form compounds.

The physical properties of the alkaline earth metals are also similar to those of the alkali metals. Alkaline earth metals are soft and silvery. They have low densities, but their densities are greater than those of alkali metals. ✓

Beryllium 4 Be 9.01
Magnesium 12 Mg 24.31
Calcium 20 Ca 40.08
Strontium 38 Sr 87.62
Barium 56 Ba 137.33
Radium 88 Ra (226)

Groups 3–12: Transition Elements

The elements in groups 3–12 are called **transition elements**. The transition elements are in two blocks on the periodic table. As shown below, one block is in the center of the periodic table. The other block is the two rows at the bottom of the periodic table.

Many colorful materials contain small amounts of transition elements. An emerald is green because it contains small amounts of chromium. A garnet is red because of the iron it contains.

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✓ Visual Check

4. Identify Circle the element in the figure with the highest atomic mass.

✓ Reading Check

5. Identify Which element reacts faster with oxygen—barium or potassium?

✓ Visual Check

6. Identify How many periods of transition elements are there in the periodic table?

Think it Over

7. Contrast Describe two differences between transition elements and alkali metals.

Reading Check

8. Locate Where on the periodic table would you expect to find elements with few or no metallic properties?

Visual Check

9. Identify Circle the most malleable metal: iron (Fe), copper (Cu), or titanium (Ti).

Properties of Transition Elements

All transition elements are metals. They have higher melting points, greater strength, and higher densities than the alkali metals and the alkaline earth metals. Transition elements also react less quickly with oxygen. Some transition elements can exist in nature as free elements rather than in compounds. Free elements occur in pure form.

Uses of Transition Elements

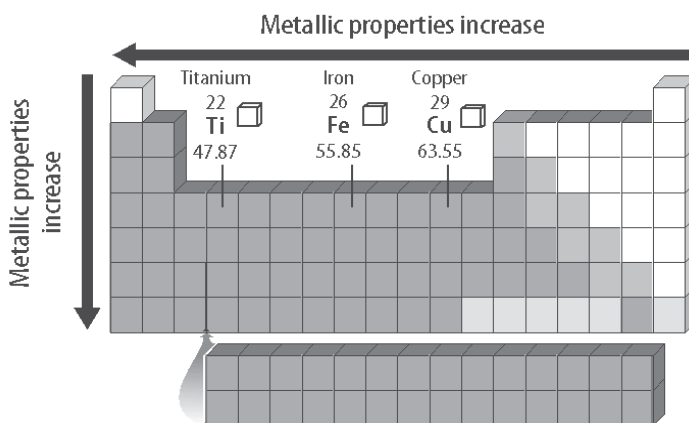
Transition elements in the middle block of the periodic table have many important uses. Because they are dense, strong, and resist corrosion, transition elements such as iron make good building materials. Copper, silver, nickel, and gold are used to make coins. Many transition elements can react with other elements and form many compounds.

Lanthanide and Actinide Series

Two rows of transition elements are at the bottom of the periodic table. They are placed below the main table to keep the table from being too wide. Elements in the first row are called the lanthanide series, and elements in the second row are called the actinide series. Some elements from both series have valuable properties. Lanthanide series elements are used to make strong magnets. Plutonium, an actinide series element, is used as a fuel in some nuclear reactors.

Patterns in Properties of Metals

The properties of elements follow repeating patterns across the periods of the periodic table. The figure below shows these patterns. Potassium (K) has more luster, is the most malleable, and conducts electricity better than all the elements in period 4. All these properties decrease from left to right across the period. The elements on the far right have no metallic properties at all. There are also patterns within groups. Metallic properties tend to increase as you move down a group. ✓



..... After You Read

Mini Glossary

alkali (AL kuh li) metal: an element in group 1 on the periodic table

alkaline (AL kuh lun) earth metal: an element in group 2 on the periodic table

ductility (duk TIH luh tee): the ability of a substance to be pulled into thin wires

luster: the ability of a metal to reflect light

malleability (ma lee uh BIH luh tee): the ability of a substance to be hammered or rolled into sheets

metal: an element that is generally shiny, is easily pulled into wires or hammered into thin sheets, and is a good conductor of electricity and thermal energy

transition element: an element in groups 3–12 on the periodic table

1. Review the terms and their definitions in the Mini Glossary. Use three terms to tell what properties metals tend to have.

2. Examine the section of the periodic table at right. Which element has properties most similar to those of chromium (Cr)? Why?

Vanadium 23 V	Chromium 24 Cr	Manganese 25 Mn
Niobium 41 Nb	Molybdenum 42 Mo	Technetium 43 Tc

3. How did underlining the main ideas help you review the material?

What do you think NOW?

Reread the statements at the beginning of the lesson. Fill in the After column with an A if you agree with the statement or a D if you disagree. Did you change your mind?



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**END OF
LESSON**