

Putting Metals to Work

You have already learned that many of the chemical substances that you encounter in everyday life have uses that are based on their physical and chemical properties. Metals, for example, have been used for thousands of years to make tools, weapons, and jewellery. Today, many different mixtures of metals, called **alloys**, are used for everything from airplane parts to braces for teeth. In each case, the metal is chosen because of its properties.

Metals and Alloys

The metal alloys used in the braces in **Figure 1** must have specific chemical properties:

- They must not react with saliva.
 - They must not react with chemicals in food.
- They must also have specific physical properties:
- They must be relatively stiff, but easy to bend into the shape of the teeth.
 - They must have enough “spring” to push or pull individual teeth into position.

The metals used in braces are not the only ones that must be unreactive. The lack of reactivity of gold and silver, for example, make them valuable for jewellery. These metals do not leave marks on the skin, nor do they become dull when exposed to air or moisture. Other metals, such as platinum, as well as mixtures of metals are used to make jewellery (**Figure 2**).

The uses of many other metals are listed in **Table 1**.

Heavy Metals

Another group of chemicals that are required in small amounts in healthy plants and animals are **heavy metals**, such as mercury and lead. In large quantities, these very dense metals can cause damage to plants and animals. The damage done by lead and mercury in humans has been well documented. Both metals affect the nervous

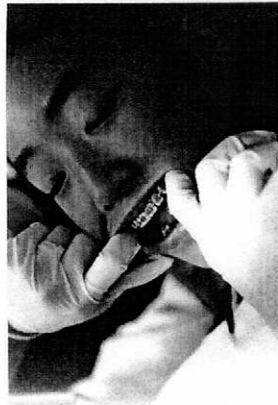


Figure 1
Braces are made from unreactive metals.

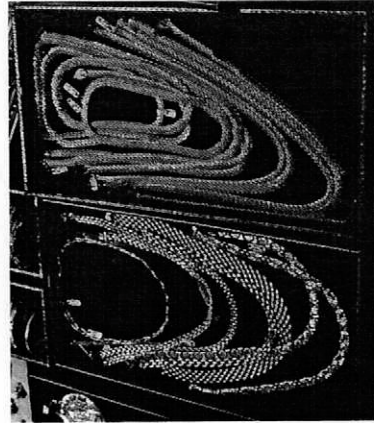


Figure 2
Jewellery that appears to be gold or silver is actually made from a mixture of these and other metals.

system and the brain. Today, lead-free paint products and gasoline have reduced human exposure to lead. Pulp mills and industrial plants that discharge mercury into freshwater systems are under pressure to reduce the amount of mercury they release (**Figure 3**).

Table 1
Metals and Their Uses

Metal	Selected properties	Typical uses
tungsten	very high melting point	light-bulb filaments
chromium	resists corrosion	chrome plating
iron	forms strong alloys	structural steel
copper	good conductor of electricity	electrical wire
nickel	resists corrosion	coins
lead	resistant to acid, soft	batteries
zinc	forms protective coating	galvanized containers
tin	resists corrosion	coating for steel cars
mercury	conductor	home thermostat switches
magnesium	light and strong	car wheels, luggage
aluminum	good conductor of heat	pots and pans



Figure 3
Mercury compounds are discharged by pulp mills and industrial plants.

Did You Know?

In the past, mercury was used in felt-making for top hats, so many hatters went mad with mercury poisoning, hence the expression “Mad as a hatter.”



Challenge

- 1 Is the substance you have chosen to market an element or a compound? What properties make it extremely useful?
- 3 You have learned about some new elements in this section. Try to find out how and when they were discovered, and by whom.

Work the Web

Research other alloys to find out what metals have been mixed together to make them. Go to www.nelson.science.com and follow the links from *Science 9: Concepts and Connections, 1.12*. Describe one use for each alloy that you find. What properties does the alloy have that make it suitable for this use?

Understanding Concepts

- 1 Name two properties that would be required of a metal used for braces for teeth.
- 2 Name a metal that is
 - (a) a good conductor of heat
 - (b) used to make jewellery
 - (c) no longer a part of gasoline
 - (d) no longer in many paint products
 - (e) used to make tire rims
- 3 Identify three chemicals that are needed in large amounts by plants.

Making Connections

- 4 If you were to eat mercury-contaminated fish, what would likely be the
 - (a) short-term effect?
 - (b) long-term effect?