Metals

Metals make up over three-quarters of the elements found naturally on Earth. and vary dramatically in appearance and behavior. However, there are key properties that most metals share.

Properties of metals

Metals are crystalline substances, so they tend to be hard, shiny, and good conductors of electricity and heat. They are dense, with high melting and boiling points, but are easily shaped by a variety of methods. But some metals buck the trend. Mercury is liquid at room temperature because its outer electrons are very stable, so it does not tend to bond to other atoms.

RUST

Many metals are highly reactive, particularly the group 1 metals (see pp.34-35). Most metals form oxides when they combine with oxygen. For example, iron forms iron oxide, also known as rust. when exposed to the oxygen in the air or water.



Allovs

Most pure metals are too soft, brittle, or reactive for practical use. Combining metals or mixing metals with nonmetals forms alloys, often with improved properties. Varying the ratios and types of metals changes the properties of alloys. One common alloy is steel—a mixture of iron, carbon, and other elements. Adding more carbon makes harder steel, which is good for building. Adding chromium creates corrosionresistant stainless steel. Other elements can also be included to increase heat resistance, durability, or toughness for use in items like car parts or drills.

Alloy composition

Copper forms two common alloys: bronze (tin is added to increase its hardness) and brass (zinc improves the alloy's malleability and durability). Stainless steel, another common alloy varies in composition.

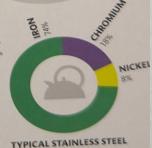


BRONZE





BRASS



IS AN OLYMPIC GOLD MEDAL **ACTUALLY GOLD?**

Only 92.5 percent of a gold medal is actually gold. The last solid gold Olympic gold medal was awarded in 1912.

The principal properties The properties of metals make them useful for a range of

Most metals are relatively strong yet tough. Their atoms compress a little after force is applied, before they

return back to their previous positions. 0000 FORCE 6866 0000

Compressed

Electrons heated on one side of a metal are free to move to the other side, conducting the heat more rapidly than if it was passed from atom to

atom, as in other materials.

Normal Examples Steel Tungsten

Titanium

Examples Copper

Brass

Heat carried through metal

Electrons in a metal can move and carry charge, making metals good electrical conductors. However, some metals, like copper and silver,

are better conductors than others.

Flow of electric

Examples Silver

Copper Gold

To melt a metal, the strong forces of attraction between the sea of negative electrons and the positive metal ions must be overcome. This takes a lot of energy in the form of heat.

Examples

Tungsten Rhenium

HIGH MELTING AND BOILING POINTS uses-from highly conductive copper wires and pans to nonreactive and easily shaped gold and platinum jewelry.

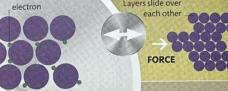
The atoms in most metals are closely packed because of the strong attraction between the delocalized electrons and the positive ions. This makes them dense and heavy for their size.

Examples

- Osmium
- @ Platinum Plutonium

The atoms can rearrange easily as the sea of electrons moves with them, making metals ductile-for example, no bonds have to break for a metal to be stretched into a wire.

Layers slide over



The structure of metals The outermost electrons in each atom are delocalized, so they are able to move between and around the ions. This is what gives metals their unique properties.

Delocalized

There are many electrons

it is absorbed and then

a lustrous glow.

re-emitted, giving metals

orbiting each edge of a metal.

without breaking their bonds, so they can be hammered into shape. When a force is

The electrons and

ions in metals move

applied, atoms roll over each other into new positions

FORCE

When light encounters these, Examples Rhodium

Aluminum

Silver

Incident light

Re-emitted

Examples

- Platinum Silver
- Iron

Examples

- Platinum
- Silver • Iron