

## 3.5: Metals



Figure 3.5.1 (Credit: User:Brianac/Wikipedia; Source: <http://commons.wikimedia.org/wiki/File:Screws.jpg>(opens in new window); License: Public Domain)

### Can you guess what types of metals these screws are made of?

Screws come in all sizes and shapes. They are all (well, almost all) made of some kind of metal. But they have differences in size, shape, and type of metal. Physical characteristics also differ. Some screws are long, and others are short. One screw may have a flat-head slot while another screw may have a Phillips-head. Some of the screws in the picture below are used to fasten things together, and others are used to hang heavy objects on a wall.

Chemists classify materials in many ways. We can sort elements on the basis of their electron arrangements. The way the electrons are distributed determines the chemical properties of the element. Another way is to classify elements based on physical properties. Some common physical properties are color, volume, and density. Other properties that allow us to sort on the basis of behavior are conduction of heat and electricity, malleability (the ability to be hammered into very thin sheets), ductility (the ability to be pulled into thin wires), melting point, and boiling point. Three broad classes of elements based on physical properties are metals, nonmetals, and metalloids.

### Metals

A metal is an element that is a good conductor of heat and electricity. Metals are also malleable, which means that they can be hammered into very thin sheets without breaking. They are ductile, which means that they can be drawn into wires. When a fresh surface of any metal is exposed, it will be very shiny because it reflects light well. This is called luster. All metals are solid at room temperature with the exception of mercury (Hg), which is a liquid. Melting points of metals display a very wide variance. The melting point of mercury is  $-39^{\circ}\text{C}$ , while the highest melting metal is tungsten (W), with a melting point of  $3422^{\circ}\text{C}$ . The elements in blue in the periodic table below are metals. About 80 percent of the elements are metals.

Figure 3.5.2 (Credit: Christopher Auyeung; Source: CK-12 Foundation; License: [CC BY-NC-SA 3.0](https://creativecommons.org/licenses/by-nc-sa/3.0/)(opens in new window))

Gold has been used by many civilizations for making jewelry (see figure below). This metal is soft and easily shaped into a variety of items. Since gold is very valuable and often used as currency, gold jewelry has also often represented wealth.

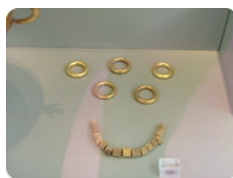


Figure 3.5.3: Gold jewelry. (Credit: User:Dorieo21/Wikimedia Commons; Source: [http://commons.wikimedia.org/wiki/File:Gold\\_rings\\_and\\_beads\\_with\\_granulated\\_decoration.JPG](http://commons.wikimedia.org/wiki/File:Gold_rings_and_beads_with_granulated_decoration.JPG)(opens in new window); License: Public Domain)

Copper is a good conductor of electricity and is very flexible and ductile. This metal is widely used to conduct electric current in a variety of appliances, from lamps to stereo systems to complex electronic devices (see figure below).



Figure 3.5.4: Copper wire exposed. (Credit: Scott Ehardt; Source: [http://commons.wikimedia.org/wiki/File:Stranded\\_lamp\\_wire.jpg](http://commons.wikimedia.org/wiki/File:Stranded_lamp_wire.jpg)(opens in new window); License: Public Domain)

Mercury is the only metal to exist as a liquid at room temperature (see figure below). This metal was extensively used in thermometers for decades until information about its toxicity became known. Mercury switches were once common, but are no longer used. However, new federally-mandated energy-efficient light bulbs that are now used contain trace amounts of mercury and represent a hazardous waste.



Figure 3.5.5: Pouring Mercury. (Credit: User:Bionerd/Wikimedia Commons and User:Materialschemist/Wikimedia Commons; Source: [http://commons.wikimedia.org/wiki/File:Pouring\\_liquid\\_mercury\\_bionerd.jpg](http://commons.wikimedia.org/wiki/File:Pouring_liquid_mercury_bionerd.jpg)(opens in new window); License: CC BY 3.0(opens in new window))



## Summary

- Metals are good conductors of heat and electricity.
- Metals are malleable and ductile
- All metals are solids at room temperature with the exception of mercury
- Gold, silver, iron, and mercury are typical metals.

## Review

1. What properties of an element are affected by electron distribution?
2. Define malleability.
3. Define ductility.
4. State one reason gold is used in jewelry.
5. Why is mercury no longer used in many devices?

This page titled [3.5: Metals](#) is shared under a [CK-12](#) license and was authored, remixed, and/or curated by [Theodore Chan](#) via [source content](#) that was edited to the style and standards of the LibreTexts platform.

- [6.5: Metals](#) by [CK-12 Foundation](#) is licensed [CK-12](#). Original source: <https://flexbooks.ck12.org/cbook/ck-12-chemistry-flexbook-2.0/>.