Characteristics of Metals

Skills to Develop

- List and explain the properties of metals

Remember that metals are on the left and bottom of the periodic table. Based on the periodic trends in the last 3 sections, this means that they are usually bigger, more likely to lose electrons, and less likely to gain electrons, than the non-metals.

Elemental Properties

In the elemental form, metals are usually shiny, can be bent or stretched, and conduct heat and electricity. This is because metals hold their valence electrons kind of loosely, because of the low IE. It's a general pattern that the closer an atom is to the noble gas electron configuration, the fewer bonds it makes. Metals are far from the noble gas configuration, so they usually make bonds to many neighbors. Thus, they have have structures in which each atom touches many neighbors (sometimes 6, usually 8 or 12). Because they don't have very many electrons, the valence electrons are shared by many atoms in a "delocalized ocean" of electrons that aren't really attached to particular atoms. These "free floating" electrons allow the metal to conduct heat and electricity. Also, because the bonds in a metal aren't pointed directly from atom to atom, they don't break easily. This means the metals can be bent and stretched. The technical words are malleable (can be pounded into foil) and ductile (can be stretched into wire). The sea of valence electrons allows the nuclei to be pushed around without separating. I don't think there's a simple explanation for why metals are shiny, though.

Reaction Patterns

Metals can mix with each other to form alloys that are similar to elemental metals. When they react with non-metals, they usually lose electrons to form cations. The cations are then attracted to the anions, so the result are ionic or sort of ionic compounds. The easier it is for a metal to lose electrons, the more reactive it is. If you haven't already, watch this video about the reactivity of the alkali metals. The metals on the right that have bigger ionization energies form more covalent compounds with non-metals, with more electron sharing and less pure electrostatic attraction. These metals are also more flexible about what ionic charge they have. See why by going to Ptable and watching the purple move right as you go from IE_1 to IE_4 or higher. The transition metals stay green: they don't take a sudden jump to much higher IE.

Contributors and Attributions

- Emily V Eames (City College of San Francisco)

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