1.4.6.2: Metallic and Nonmetallic Character

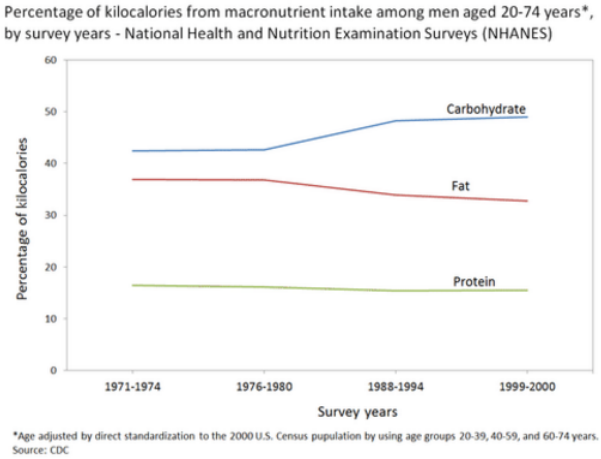

Figure 1.4.6.2.1: Graph indicating eating habits of American men from 1971 to 2000. (Credit: Recreated by CK-12 Foundation based on data from the CDC; Source: CDC GOV Preview(opens in new window) [www.cdc.gov]; Flickr, Venn Diagram(opens in new window) [www.flickr.com]; License: Public Domain)

What are we eating as a nation?

The graph above indicates some trends in the U.S. diet over a thirty-year period. By observing the direction our eating habits are going, steps can be taken to help prevent bad eating habits and decrease problems such as high blood pressure and heart attacks.

Development of the periodic table has helped organize chemical information in many ways. We can now see trends among properties of different atoms and make predictions about the behavior of specific materials.

Metallic and Nonmetallic Character

Metallic character refers to the level of reactivity of a metal. Metals tend to lose electrons in chemical reactions, as indicated by their low ionization energies. Within a compound, metal atoms have relatively low attraction for electrons, as indicated by their low electronegativities. By following the trend summary in the figure below, you can see that the most reactive metals would reside in the lower left portion of the periodic table. The most reactive metal is cesium, which is not found in nature as a free element. It reacts explosively with water and will ignite spontaneously in air. Francium is below cesium in the alkali metal group, but is so rare that most of its properties have never been observed.

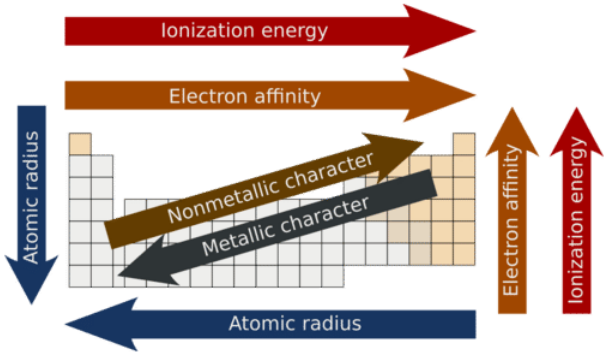

Figure 1.4.6.2.2: Trends in behaviors of elements. (Credit: User:Mirek2/Wikimedia Commons; Source: Commons Wikimedia, Periodic Trends(opens in new window) [commons.wikimedia.org]; License: Public Domain)

Reactivity of metals is based on processes such as the formation of halide compounds with halogens, and how easily the element displaces hydrogen from dilute acids.

The metallic character increases as you go down a group. Since the ionization energy decreases going down a group (or increases going up a group), the increased ability for metals lower in a group to lose electrons makes them more reactive. In addition, the atomic radius increases going down a group, placing the outer electrons further away from the nucleus and making that electron less attracted by the nucleus.

Nonmetals tend to gain electrons in chemical reactions, and have a high attraction for electrons within a compound. The most reactive nonmetals reside in the upper right portion of the periodic table. Since the noble gases are a special group because of their lack of reactivity, the element fluorine is the most reactive nonmetal. It is not found in nature as a free element. Fluorine gas reacts explosively with many other elements and compounds, and is considered to be one of the most dangerous known substances.

Note that there is no clear division between metallic and **non-metallic** character. As we move across the periodic table, there is an increasing tendency to accept electrons (nonmetallic) and a decrease in the possibility that an atom will give up one or more electrons.

Summary

- Metallic character refers to the level of reactivity of a metal.
- Non-metallic character relates to the tendency to accept electrons during chemical reactions.
- Metallic tendency increases going down a group.
- Non-metallic tendency increases going from left to right across the periodic table.

Review

1. Define “metallic character.”
2. Define “non-metallic character.”
3. Describe the trend in metallic character going down a group.
4. Describe the trend in non-metallic character going across the periodic table.
5. Why does the metallic character increase as you go down a group?
