NS 3.3 (pg 1 of 1) Navigating Around the Periodic Table

About 70 elements had been discovered by the mid 1800's. Be sure and check out the periodic chart on the chapter 3 home page on the web site that gives a colorful representation of when the elements were discovered. Dmitri Mendeleev, a Russian chemistry professor was writing a book for his chemistry students and in his attempt to organize the known elements he noticed that when the elements were arranged in columns and rows, increasing mass from left to right, that the columns were arranged with elements that had similar chemical properties. Mendeleev's original periodic table had gaps in it to represent the elements that had not yet been discovered. He even went so far as to predict the properties of a few of those undiscovered elements. His predictions were remarkably accurate when those elements were finally isolated. Mendeleev's chart did have some irregularities, and he assumed that this may have been caused by errors in the measurements of the masses of the elements. Subsequently, the mass measurements were shown to be remarkably accurate.

Forty years later in 1913 Henry Mosley had determined that the nucleus of each element has a positive charge unique to that element. Mosley decided to rearrange Mendeleev's chart in order of increasing nuclear charge instead of by increasing mass. Mosely's improvement to the chart remains today as the modern periodic chart is arranged in order from left to right by increasing number of protons.

The periodic chart is periodic, meaning that it exhibits repeating patterns and trends of the properties of the elements. These trends can be analyzed both vertically and horizontally. The trends that we will eventually study will be:

1 electron arrangement
2 atomic size
3 ionic size
4 ionization energy
5 electron affinity
6 electronegativity

It is important to make friends with the periodic chart so that you can navigate around it.
Column, group, or family, are the three terms used to describe a vertical set of elements.
Row or period is the term used to describe a horizontal set of elements.

Metals and Nonmetals

It is extremely important to recognize the staircase that separates the metal elements from the nonmetals. All elements to the left are metals (which exhibit physical characteristics such as high heat and electrical conductivity, shiny luster, all are solid at room temp except for mercury), and all elements to the right (and hydrogen as well) are nonmetals (which exhibit characteristic properties that are different from the metals). Many elements along the stairs separating the metals from the nonmetals exhibit both metal and nonmetal physical properties. These elements are sometimes classified as metalloids. Silicon and germanium are two of these important elements.

Representative Elements

The elements in the columns headed by the numbers 1 – 8 are known as the representative elements and will be a focus of a large part of this course.

Noble or Inert Gases

The last column (group 8) to the far right headed by helium ($_2$He) is known as the Noble or inert gases. They are considered inert because they participate in very few chemical reactions.

Halogens

The elements in group 7 headed by the element fluorine are known as the halogens.

Alkali Metals

The metals in column 1 headed by the metallic element lithium are known as the alkali metals.

Transition Metals (group B)

The elements in between and including Sc and Zn are known as the transition metals.

Lanthanide and Actinide Series

The elements in the bottom row of the periodic chart are not very uncommon, are all radioactive, and are known as the actinide series. The row just above it is known as the lanthanide series and is equally uncommon. These elements will not be the focus during the rest of this course.