

## 6.4.3 The Periodic Table

### What's the deal with the periodic table?

The periodic table is basically just a list of all the elements that we know about. Because of the way it's set up, we can use it as a reference source for figuring out all kinds of information.

### What are the important parts of the periodic table?

#### 1. **Metals, nonmetals, and metalloids:**

The periodic table tells you where the metallic, nonmetallic, and semimetallic metals are. To the right of the periodic table, starting to the left of boron (element #5, B) you should see a line that looks like a staircase. Elements far to the left of this line are metals, elements to the far right of this line are nonmetals, and elements right around the line on either side are semimetals, or metalloids.

To review:

**Metals** are conductors of heat and electricity, malleable, ductile, and generally solid.

**Nonmetals** may be solids, liquids, or gases, and are poor conductors of heat and electricity. When solids, they are brittle, non-lustrous materials.

**Metalloids** are solids at standard conditions, and are semiconductors of electricity, making them handy for use in the electronics field. Metalloids have properties between that of metals and nonmetals, causing them to have the nickname of "semimetals."

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#### 2. **The families of the periodic table:**

The periodic table consists of a whole bunch of different families which share similar properties. Families are columns in the periodic table, also referred to as groups.

- **Alkali metals** are group 1. They are highly reactive elements with low melting and boiling points. They are light, soft metals. They tend to form ions with a +1 charge.
- **Alkaline earth metals** are group 2. They are also reactive, but less so than the alkali metals. They are light, soft metals, but stronger and denser than the alkali metals. They tend to form ions with a charge of +2.
- **Transition metals** are in groups 3-12. They are less reactive than the alkali and alkaline earth metals, but vary greatly among themselves in reactivity. Generally, these elements form cations, but the amount of positive charge these elements have depends on what the metals are reacting with.
- **Lanthanides** are the metals in the 4f part of the periodic table. They are generally reactive, shiny metals with various industrial purposes. Like the transition metals, they form cations with varying amounts of charge.
- **Actinides** are metals in the 5f part of the periodic table. Most are radioactive and man-made. Uses of these elements are primarily in the generation of nuclear power or in nuclear

- explosives. Small amounts of elements such as americium are used in smoke detectors.
- **Chalcogens** are group 16 in the periodic table. Starting with oxygen, these elements are mostly nonmetallic and somewhat electronegative, forming ions with a -2 charge.
  - **Halogens** are group 17 in the periodic table. These elements are highly reactive oxidizers, and all form ions with a -1 charge. All are electronegative. All are also extremely dangerous, especially when inhaled.
  - **Noble gases** are group 18 in the periodic table. They basically don't react with anything because they have a stable octet. They used to be called the inert gases, but it was found a while back that some can form somewhat unstable compounds with halogens and oxygen.
  - **Hydrogen** is element #1 in the periodic table. It is unlike any other element, and is fairly reactive. Depending on what it reacts with, it can either form a +1 ion (hydronium ion, or "proton") or a -1 ion (hydride ion) - generally, the hydronium ion is easier to form than the hydride ion.

### What else can I do with the periodic table?

**The following enhanced information is somewhat complicated material for the grade 9 level. If you read the following and do not understand it, don't worry about it because this will be dealt with at the grade 11 chemistry level again.**

Boy, am I ever glad you asked! You can find the electron configurations of any element using the periodic table by remembering that the two rows at the far left are S rows, the transition metals in the middle are D rows, the main block elements to the right are P rows, and the lanthanides and actinides are F rows. Likewise, the first S orbital you write down will be the 1s orbital, the first P orbital you write will be the 2p orbital, the first D orbital you write will be the 3d orbital, and the first F orbital you write will be the 4f orbital. If you're not too clear about how this works, take a look at a periodic table that has the electron configurations written out and see if it doesn't make a bit more sense.

You can use the periodic table to figure out which elements are most electronegative. (Electronegativity is a measurement of how much elements try to steal electrons from other atoms they're bonded to.) Electronegativity increases as you move from the left side of the table to the right side because elements on the right want to gain electrons to be like the nearest noble gas. Electronegativity decreases as you move down each family because of the shielding effect (inner electrons tend to shove the outer ones away, so the more electrons you have, the less tightly-bound the outer electrons).

Atomic radius increases as you move down each family (there are more energy levels) and decreases as you move from left to right (because the nucleus gets more positive charge but the electrons keep the same amount of energy all the way across).