

## MATTER

Have you ever wondered why water is a liquid, oxygen is a gas, and sugar is a solid? Or, have you wondered why chlorine gas will kill you if you breathe it but when chlorine is combined with sodium, it is necessary for normal body function and we would die without it? What about fats? Why won't they dissolve in water while salt and sugar do? In the following reading, we will try to answer these and other questions dealing with the chemicals that make up our bodies.

All living and non-living things are composed of **matter**. Using one of its most simple definitions, "Matter is anything that occupies space and has **mass**". Mass is simply the amount of matter that an object contains. Oft times, mass and weight are confused. Weight is a function of gravity pulling on matter. For example, your body is composed of a certain quantity of matter that, when acted upon by gravity, results in your weight of say 150 pounds. If you took that same amount of matter to the moon where the gravitational force is only 1/6 of that of the earth, you would only weigh 25 pounds.

Matter is composed of **elements**. Chemists define elements as "substances that cannot be broken down into simpler materials by chemical processes". Some common elements that you have probably heard of are carbon, hydrogen, oxygen, and nitrogen. The building blocks for elements are atoms, which we will discuss in more detail later. In nature, there are 92 naturally occurring elements. In addition to these, a number have been artificially produced. Based on their chemical properties, these elements can be organized into what is referred to as the **periodic table of the elements**. We will refer back to this table frequently as we discuss the basic chemistry of the elements.

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### Periodic Table of the Elements, created by BYU-I student Hannah Crowder, Spring 2011

The figure above is a "Periodic Table of the Elements." The elements highlighted in yellow make up 96% of our body weight. The nine elements highlighted in green, along with those in yellow, are considered major essential elements. The elements highlighted in blue are considered minor essential elements and are required only in trace amounts in the body. Notice that each element is represented by a 1 or 2 letter symbol. Often, these symbols are the first letter or letters in the name of the element: **H** for hydrogen, **C** for carbon, and **He** for helium. Occasionally, however, the symbols represent the Latin name for the element; hence, the symbol for sodium is **Na** for the Latin Natrium, and the symbol for Potassium is **K** for the Latin Kalium.

Of the 92 naturally occurring elements, four make up roughly 96% of our body weight, namely **Carbon** (C), **Hydrogen** (H), **Oxygen** (O) and **Nitrogen** (N) (Figure above, yellow highlight). In addition to these four, there are a number of other important, but less abundant, elements found in the body. These include Phosphorus (P), Sodium (Na), Potassium (K), Calcium (Ca), Magnesium (Mg), Sulfur (S), Chlorine (Cl), Iron (Fe), and Iodine (I) (Figure above, green highlight). Having a solid understanding of the elements highlighted in yellow and green will be important as we continue in the study of the human body and cell processes. The elements that are required in trace amounts for normal functioning include Vanadium (V), Chromium (Cr), Manganese (Mn), Cobalt (Co), Molybdenum (Mo), Zinc (Zn), Silicon (Si), Fluorine (F), Selenium (Se) and Tin (Sn) (Figure above, blue highlight).

Subatomic Particles

Electron Configurations

Chemical Bonds



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