

## 2.11: Some Things to Know About Chemistry before You Even Start

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Chapters 3-7 explain the basic principles of chemistry as they relate to green chemistry. For even greater detail on the basics of chemistry the reader is referred to a book on that subject.<sup>3</sup> However, at this point, it is useful to have a brief overview of chemistry, in a sense a minicourse in chemistry that provides the basic definitions and concepts of chemistry such as chemical compounds, chemical formulas, and chemical reactions before they are covered in detail in the later chapters.

All chemicals are composed of fewer than 100 naturally-occurring fundamental kinds of matter called elements. Humans have succeeded in making about 30 artificial elements since the late 1930s, but the amounts of these are insignificant compared to the total of known chemicals. Elements, in turn, are composed of very small entities called atoms. Atoms of the same element may differ a bit in their masses, but all atoms of the same element behave the same chemically. So we can logically begin the study of chemistry with the atoms that make up the elements of which all matter is composed.

Each atom of a particular element is chemically identical to every other atom. Each element is given an atomic number specific to the element, ranging from 1 to more than 100. The atomic number of an element is equal to the number of extremely small, positively charged protons contained in the nucleus located in the center of each atom of the element. Each electrically neutral atom has the same number of electrons as it has protons. The electrons are negatively charged and are in rapid motion around the nucleus, constituting a cloud of negative charge that makes up most of the volume of the atom. In addition to its atomic number, each element has a name and a chemical symbol, such as carbon, C; potassium, K (for its Latin name kalium); or cadmium, Cd. In addition to atomic number, name, and chemical symbol, each element has an atomic mass (atomic weight). The atomic mass of each element is the average mass of all atoms of the element so it is not a whole number. Atoms of most elements consist of two or more **isotopes**. All isotopes of the same element have identical chemical properties but differ in mass because of the presence in their nuclei of differing numbers of electrically neutral neutrons (see Chapter 3).

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