OVERVIEW OF CHEMISTRY

What is chemistry? All definitions of chemistry include the study of *matter. Matter is defined as anything that has mass and occupies space.* All matter is arranged or organized. The way it is arranged is called its *structure.* The parts of the structure and the ratio in which they are organized are called its *composition.* In addition, all matter has characteristics or *properties.* That is, each *substance* has a set of properties that are characteristic of that substance and give it a unique or special identity. These physical or chemical properties are the "personality traits" of that substance. In brief, chemists study the properties, the composition, and the structure of matter. They also study changes in the composition and the structure as well as the *reactions* of matter, especially of atomic and molecular systems. Basically, *chemistry is a science that deals with the composition and properties of substances and with the reactions by which substances are produced from, or converted into, other substances.*

People have practiced chemistry since ancient times. The Egyptian, Arabic, Greek, and Roman cultures each contributed significant developments to chemistry. These early developments were *empirical.* That is, they were achieved by trial and error and were not based on any valid theory of matter. The alchemists (500-1600 A.D.) whose practical goal was to change base metals into gold and to prolong life, also contributed to the development of chemistry. However, it was not until the 17th and 18th centuries that modern chemistry began to develop through systematic experimentation rather than trial and error. In fact, this systematic experimentation, called *the scientific method,* is usually credited with being the most important single factor in the development of chemistry and its application to technology.

Chemistry is related to physics, another basic branch of science. It is also related to biology, the science of life, because life itself is basically a complicated system of interrelated chemical processes.

The range, or scope, of chemistry is very wide. In fact, it includes the whole universe and every animate (living) and inanimate (nonliving) thing in it. Chemistry may be broadly classified into two main branches: *organic* chemistry (the chemistry of living things) and *inorganic* chemistry (the chemistry of nonliving things). Through the study of chemistry we try to learn and understand the *principles* and *laws* that control the activity of all matter.

Chemists may try to observe and to explain natural situations, or phenomena, or they may invent experiments that will show the composition and structure of complex substances. They may look at methods to improve natural processes or, sometimes, create or combine substances that are unknown in nature.

Even though the total of chemical knowledge is so enormous that no one could learn all of it in one's lifetime, the basic *concepts* are not difficult. In fact, these fundamental concepts in chemistry have become part of the education required for many professionals in a wide variety of fields and they have contributed to the rapid growth of technology.

What is chemistry? A popular dictionary gives this definition: Chemistry is a science of the composition, structure, properties, and reactions of matter, especially of atomic and molecular systems. Another, somewhat simpler dictionary definition, is: Chemistry is a science dealing with the composition of matter and the changes in composition that matter undergoes. Neither of these definitions is entirely adequate. Chemistry, along with the closely related science of physics, is a fundamental branch of knowledge. Chemistry is also closely related to biology, not only because living organisms are made of material substances but also because life itself is an essentially complicated system of interrelated chemical processes.

The scope of chemistry is extremely broad. It includes the whole universe and everything, animate and inanimate, in it. Chemistry is concerned not only with the composition of matter, but also with the energy and energy changes associated with matter. Through chemistry we seek to learn and to understand the general principles that govern the behaviour of all matter.

The chemist, like other scientists, observes nature and attempts to understand its secrets: What makes a rose red? Why is sugar sweet? What is occurring when iron rusts? Why is carbon monoxide poisonous? Why do people wither with age? Problems such as these - some of which have been solved, some of which are still to be solved - are part of what we call chemistry.

A chemist may interpret natural phenomena, devise experiments that will reveal the composition and structure of complex substances, study methods for improving natural processes, or, sometimes, synthesize substances unknown in nature. Ultimately, the efforts of successful chemists advance the frontiers of knowledge and at the same time contribute to the well-being of humanity. Chemistry can help us to understand nature, however, it is not necessary to be a professional chemist or scientist to enjoy natural phenomena. Nature and its beauty, its simplicity within complexity, are for all to appreciate.

The body of chemical knowledge is so vast that no one can hope to master it all, even in a lifetime of study. However, many of basic concepts can be learned in a relatively short period of time. These basic concepts have become part of the education required for many professionals including agriculturists, biologists, dental hygienists, dentists, medical technologists, microbiologists, nurses, nutritionists, pharmacists, physicians, and veterinarians, to name just a few.