

Preface

All things are made of a substance called matter. You can think of matter as everything that is not empty space. Many people believe that the space around them is empty space. While this may be true for an astronaut on a space walk, it is not true for us here on earth. So what kind of matter surrounds you in this "empty" space? Well, one would hope that air would be in the vicinity. Although we can not see the air, it is all around us. Air is made of tiny units of matter, moving rapidly and bouncing off one another and other things. What can make up substances that are so important but invisible? If everything is made up of atoms, then how can all matter be so different? Atoms can have different numbers of protons, electrons, and neutrons. These different numbers of subatomic particles define the different elements. An element is a pure substance made up of only one kind of atom. Examples of different elements include Hydrogen, Carbon, Sulfur, Oxygen, Nitrogen and Phosphorus. There are many more elements such as Gold, Silver, Mercury or Uranium, but the elements listed first are the ones that generally compose organic matter.

Different elements have very different physical properties or characteristics. Atoms of the same element have the same number of protons, electrons, and neutrons. However, atoms of different elements have different numbers of protons, electrons, and neutrons. All protons are identical to one another, as are all electrons and all neutrons. It is only the number of these subatomic particles that creates the different properties found among the elements. Take Hydrogen and Helium as an example. Hydrogen has one proton and one electron. Helium has two protons, two electrons, and two neutrons. How different are Hydrogen and Helium from each other? They are both gases and they are both lighter than air. However, the Hindenberg blimp that burned in a matter of minutes was filled with Hydrogen, which is extremely flammable. The Goodyear blimp is filled with Helium, which is non-flammable and called an inert, or non-reactive gas. Although the difference in the numbers of protons and electrons is not great between Hydrogen and Helium, these two elements have

very different properties. All elements can be identified by their atomic mass and atomic number. These two values can tell you how many protons, electrons, and neutrons are in any element. The following are examples of the atomic mass and atomic number for the atoms found in several different elements.

The book provide a clear understanding of the principles, applications and limitations of the various techniques involved in analytical chemistry.

—*Editor*