



FIGURE A1.3.  
The structure of Atoms

of atoms (see figure A1.3). The nucleus in the center of an atom is composed of particles that carry a positive electrical charge known as protons and electrically neutral particles known as neutrons. Orbiting about the nucleus are negatively charged particles known as electrons which are equal in number to the positively charged protons.

A *nuclide* is a single kind or type of atom with a particular *atomic number* and *mass number*. The *atomic number* is the number of protons in its nucleus (or the number of electrons in its shell—both numbers are always the same). The *mass number* is the sum of the number of protons plus the number of neutrons in the nucleus. The *atomic number* determines the *element* to which the atom belongs. Thus, in Figure A1.3, both carbon 12 and carbon 14 have the same atomic number of 6. However, these *nuclides* have different *mass numbers*, 12 and 14 respectively, because carbon 14 has two more neutrons than carbon 12. They are said to be different *isotopes* of the element carbon.

How does the radioactive time clock work? Certain kinds of nuclides are radioactive. They are unstable. That is, their atomic nuclei spontaneously break up or decay to form more stable nuclides of other elements. The unstable radioactive nuclides are known as the "parent" material. The stable nuclides into which they decay is known as the "daughter" material.

A given quantity of parent radioactive material decays into stable daughter material at a known and constant rate. Two points are important here. The first point is that it is not the individual atom that decays at a constant rate, but rather the mass of radioactive