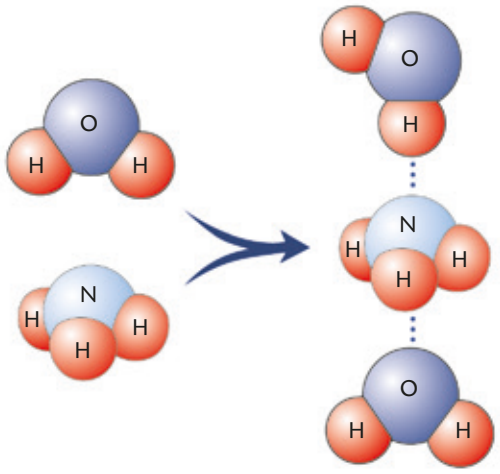

Figure 1.9 Hydrogen bonds between water and ammonia. Both oxygen and nitrogen atoms form polar covalent bonds with hydrogen atoms. The ammonia and water molecules therefore bind to each other by electrostatic attraction between the weakly positive hydrogen atoms in one molecule and the weakly negative nitrogen or oxygen atoms in another.

as 180.2 g of glucose. The symbol for mole, or amount of substance, is mol. The mole concept is also used to express the number of atoms, ions, and formula units. For example, when 1 mol NaCl, ordinary table salt, is dissolved in water, the solution contains 1 mol Na^+ and 1 mol Cl^-.

The concentration of a dissolved substance is often expressed as the number of moles of the dissolved substance per liter of solution. The unit of measure is then mol/L, which is also termed M. Instead of writing the word concentration, it is customary to use square brackets. For example, [Na^+] refers to the concentration of Na^+.

?

32 How much is one mole of a chemical compound?

33 What is the basic unit of measure for concentration?

Diffusion

In gas mixtures and solutions in which the substances are unevenly distributed initially, all concentration differences will gradually disappear over time. Such transport of substances from regions of higher concentration to regions of lower concentration occurs by a process called *diffusion*, and is the result of the random thermal motions of molecules, atoms, and ions (p. 2). The speed of the particles is inversely related to their size. In water at normal body temperature, a water molecule moves at an average speed of about 2500 km/h. In contrast, the average speed of a glucose molecule, which is ten times heavier than a water molecule, is about 850 km/h. The molecules collide continuously with other molecules. As a result of these collisions, they change direction all the time in a random pattern (Fig. 1.10).

Diffusion is transport down concentration gradients due to thermal motion

Diffusion is a very important transport mechanism in living organisms. Oxygen, nutrients, and hormones are examples of compounds that are transported in bulk between the organs of the body by the circulatory system. However, transport over the last crucial distance, through the interstitial fluid to the cells, occurs by diffusion (p. 487). Likewise, waste products from the cells are transported to the blood by diffusion. Most transport of substances within cells also takes place by diffusion.

Transport through the interstitial fluid, between the blood and the cells, occurs by diffusion

In an imaginary experiment, a water tank is divided into two compartments with a dividing wall (Fig. 1.11). In the left half, a certain amount of a substance is dissolved, and the dividing wall is then removed (a). Due to random thermal motions, some of the dissolved molecules will, in time, end up in the right half (b). At any given point in time, the probability that each individual molecule will move to the right is exactly the same as the probability that it will move to the left. Because there are initially more dissolved

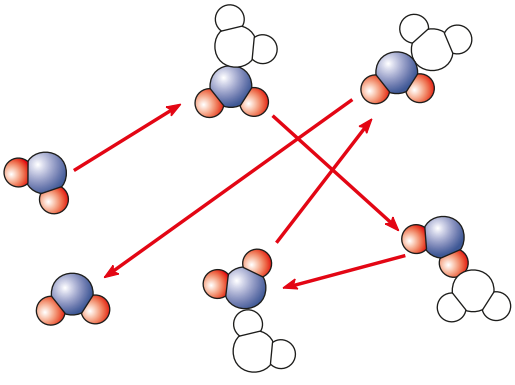

Figure 1.10 The thermal motion of molecules causes them to collide with each other and change direction continuously.