

Section 6.2

Water and Diffusion

North Carolina Objectives Objective 2.03 Investigate the cell as a living system including: Movement of materials into and out of cells

Before You Read

This section tells about the importance of water in our bodies and in other living organisms. How important is water in your life? Could you go a day without using water? On the lines below, list the ways water is important in your life.

Read to Learn

Water and Its Importance

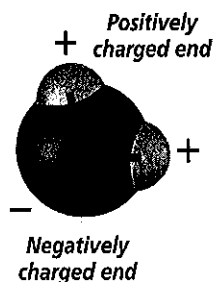
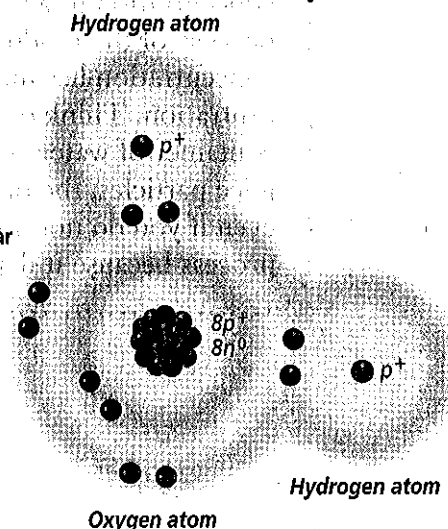
When was the last time you had a drink of water? Water is perhaps the most important compound in living organisms. In fact, water makes up 70 to 95 percent of most organisms.

What are the facts about water?

You learned in the last section that when two atoms share electrons, the force that holds them together is called a covalent bond. This group of atoms held together by a covalent bond forms a molecule. Some molecules do not share the electrons equally. They form a polar bond. A molecule with a polar bond is called a **polar molecule**.

A polar molecule has a positive end and a negative end. For example, the electrons in a water molecule spend more time near the oxygen nucleus than they do near the hydrogen nuclei. This makes water a polar molecule. Part A of the figure to the right shows a water molecule. Part B of the figure shows that a water molecule is a polar molecule.

A In a covalent bond between hydrogen and oxygen, the electrons spend more time near the oxygen nucleus than near the hydrogen nucleus.



B Since oxygen attracts the electrons more than hydrogen does, the oxygen end of a water molecule is slightly negative and the hydrogen end is slightly positive.

STUDY COACH

Identify the Main Point
Skim the section and highlight the main idea of each paragraph.

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Water and Diffusion, *continued* Reading Check

1. What allows water to dissolve salt and sugar?

Polar water molecules attract ions. You learned in the last section that ions are positively and negatively charged atoms. Because of this attraction, water can dissolve many ionic compounds such as salt. It also can dissolve many other polar molecules such as sugar. ☑

Water molecules also attract other water molecules. The positively charged hydrogen atoms of one water molecule attract the negatively charged oxygen atoms of another water molecule. When water molecules bond with other water molecules, they form a weak bond called a **hydrogen bond**. Hydrogen bonds are important because they hold molecules, such as proteins, together.

Because water is a polar molecule, it is able to creep up thin tubes, such as those found in plants. This allows plants to get water from the ground.

Water has a number of other special characteristics. Water resists temperature changes. It takes more heat to raise the temperature of water than it does to raise the temperature of most other liquids. Water also loses a lot of heat when it cools. Water expands when it freezes. As a result, ice is less dense than liquid water. This is why ice floats when it forms in water.

Diffusion

Atoms and molecules of gases, liquids, and some solids move randomly. The molecules, or particles, have energy of motion. They constantly move in straight lines until they collide with other particles. When one particle hits into another particle, both rebound off each other and move in different directions.

Diffusion happens when particles move from an area of higher concentration to an area of lower concentration. Diffusion results because of the random movement of particles. An area of higher concentration has more particles in it than an area of lower concentration. Think of concentrated orange juice. If placed in a container of water, which has a lower concentration of orange juice particles, the orange juice will begin to spread into the water even if you do not mix it. This is diffusion. Diffusion is a slow process because it depends on the random movement of particles.

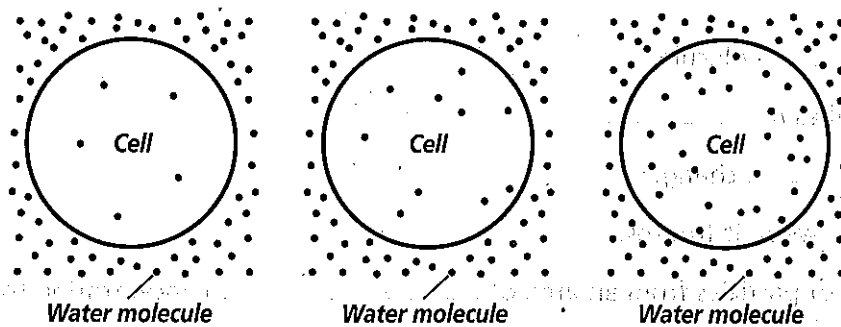
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Water and Diffusion, *continued***What affects the speed of diffusion?**

There are three factors that affect how quickly particles diffuse: concentration, temperature, and pressure. Concentration is the main factor in controlling the speed of diffusion. The more concentrated a substance, the more quickly it diffuses. When there are more randomly moving particles, there are more collisions among them. More collisions increase the chance that the particles will bump each other into areas where no other particles exist. If temperature increases, the particles' motion speeds up (think of boiling water). This speeds up the diffusion process. Increasing pressure will also speed up particle motion. This, too, speeds up diffusion.

Result of Diffusion Diffusion is complete when all the particles in a mixture become evenly distributed or mixed. At this point, the particles are still moving, but the concentration of the particles will not change. This is called **dynamic equilibrium**. The figure below shows how diffusion occurs. The last illustration in the figure shows dynamic equilibrium.



Diffusion in Living Systems Diffusion is one of the ways cells move substances in and out of the cell. This is also illustrated in the figure above. Notice in the first illustration that the concentration is higher outside the cell. In the second illustration, the concentration level in the cell is increasing. In the last illustration, the concentration level is equal on the inside and outside of the cell. In other words, there is dynamic equilibrium.

**Think it Over**

2. Apply Which will diffuse more quickly? (Circle your choice.)

- a. concentrated orange juice in cold water
- b. concentrated orange juice in warm water

Reading Check

3. Why do cells use diffusion?

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Water and Diffusion, *continued*

► After You Read

Mini Glossary

diffusion: random movement of particles from an area of higher concentration to an area of lower concentration

dynamic equilibrium: result of diffusion where there is continuous movement of particles but no overall change in concentration

hydrogen bond: weak chemical bond formed by the attraction of positively charged hydrogen atoms to other negatively charged atoms

polar molecule: molecule with an unequal distribution of charge, resulting in the molecule having a positive end and a negative end

1. Review the terms and their definitions in the Mini Glossary above. Select one term and write a definition of it in your own words.

2. Complete the sentences about water and diffusion with information you learned from your reading.

- Water is a _____ molecule.
- Water can creep up thin tubes in _____.
- Water resists _____ changes.
- Water _____ when it freezes.
- Diffusion is the movement of particles from an area of _____ concentration to an area of _____ concentration.
- The three factors that affect the rate of diffusion are _____, _____, and _____.
- Diffusion allows cells to move substances _____ and _____ of the cell.



Visit the Glencoe Science Web site at science.glencoe.com to find your biology book and learn more about water and diffusion.