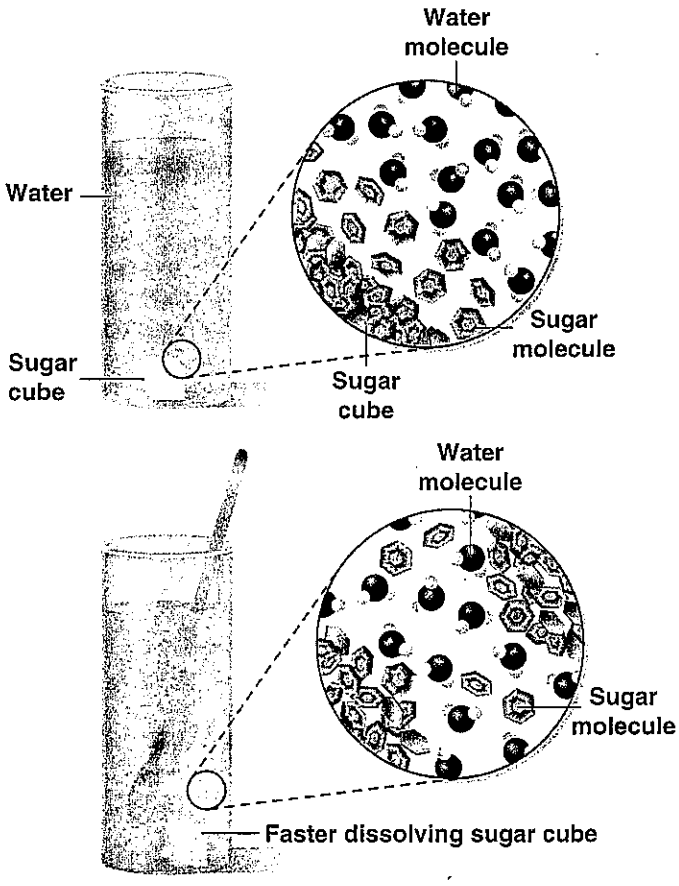
5-4 How can you change the rate at which substances dissolve?

Objective

Describe four ways to speed up the rate of dissolving.

Stirring Solutions form when a solute dissolves in a solvent. The rate at which a solid solute dissolves can be changed. Certain factors can speed up the rate at which a solute dissolves. Stirring a solution will make the solute dissolve faster. If you put a cube of sugar into a glass of water, it will eventually dissolve. However, stirring the water will cause the sugar to dissolve faster. Stirring the water causes the sugar molecules to leave the crystals more rapidly.



▲ **Figure 5-11** Stirring (bottom) causes sugar to dissolve faster.

1 **INFER:** Why does stirring make a sugar cube dissolve faster in water?

Temperature The temperature of a liquid solvent affects the rate at which a solid solute dissolves. A cube of sugar dissolves faster in hot water than in an equal amount of cold water. Heat increases the motion of water molecules. This increased energy helps to separate sugar molecules more quickly. As the temperature of a liquid solvent increases, the rate at which a solid solute dissolves also increases.

Some gases, such as oxygen and carbon dioxide, are soluble in water. Increasing the temperature of a liquid solvent has the opposite effect on gaseous solutes than it does on solid solutes. As the temperature of the solvent increases, the dissolving rate of a gaseous solute decreases.

2 **RELATE:** What is the relationship between the temperature of a liquid solvent and the rate at which a solid dissolves in it?

Surface Area The size of the particles of a solid solute also affects the rate at which it dissolves. The smaller the size of the solute particles, the faster the solute dissolves. A crushed sugar cube dissolves faster in water than does a solid sugar cube placed in an equal amount of water at the same temperature. As the size of the solute particles decreases, the rate at which the solute dissolves increases.

3 **PREDICT:** Which would dissolve faster in the same amount of water at the same temperature, a sugar cube or powdered sugar?

Pressure The solubility of most gases is affected by pressure. When pressure is increased, more gas can dissolve. For example, when you open a bottle or can containing a carbonated soft drink, you hear the gas escaping. This is because carbon dioxide is added under high pressure. However, pressure has little effect on the dissolving of solids or liquids.

4 **HYPOTHESIZE:** Why do you think more gas can dissolve when pressure is increased?

Name _____ Class _____ Date _____

5-4 How can you change the rate at which substances dissolve?

Lesson Review

Write *true* if the statement is true. If the statement is false, change the underlined term to make the statement true. Write your answers in the spaces provided.

_____ 1. Stirring a solution will make the solute dissolve slower.

_____ 2. As the temperature of a liquid solvent increases, the rate at which a solid solute dissolves decreases.

_____ 3. As the size of solute particles increases, the rate at which the solute dissolves increases.

_____ 4. When pressure is increased, more gas can dissolve in a solution.

_____ 5. Heat causes molecules of sugar to leave a sugar crystal more rapidly when placed in a solution.

_____ 6. The rate at which a solid solute dissolves can be changed.

_____ 7. The larger the size of solute particles, the faster the solute dissolves.

_____ 8. A sugar cube dissolves faster in a glass of cold water than in a glass of hot water.

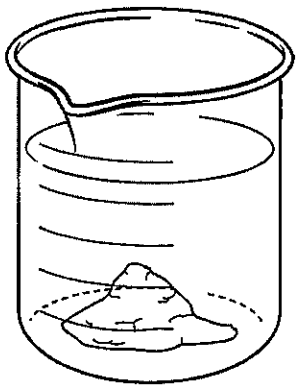
_____ 9. Polar solvents will not dissolve compounds made up of polar molecules.

_____ 10. A cool solvent dissolves less solute than an equal amount of warm solvent.

Skill Challenge

Skills: *synthesizing, relating*

Use the diagram below to answer the following questions.



1. Is the solid at the bottom of the beaker dissolved or not dissolved?

_____

2. What would happen if the beaker and its contents were heated?

_____

3. Why would stirring the water cause the solute to dissolve faster?

_____

_____

4. How would crushing the solute change the rate at which it dissolves?

_____

_____