Analysis

(b) Answer the Question: Which of the substances have high solubility in water? Which have low solubility in water?

Evaluation

(c) What additional observations would be useful to improve the quality of the Evidence?

(d) Compare the experimental and predicted results and evaluate the Prediction.

Practice

Understanding Concepts

3. Distinguish between intramolecular and intermolecular forces.
4. Suppose someone spilled some gasoline while filling a gas tank on a rainy day.
   (a) If some gasoline ran into a puddle of water, would it dissolve in the water? What evidence would support your prediction?
   (b) What rule did you use to predict whether dissolving will occur?
   (c) How does this rule apply to the gasoline-water mixture?
5. Windshield washer fluid contains methanol dissolved in water.
   (a) Why does methanol dissolve well in water? Explain in terms of intermolecular forces.
   (b) Draw a Lewis structure of a methanol molecule and several water molecules to show possible hydrogen bonds. (Use dashed lines to represent H-bonds.)
   (c) What would you expect to be the relationship between the number of possible hydrogen bonds and the solubility? Why?

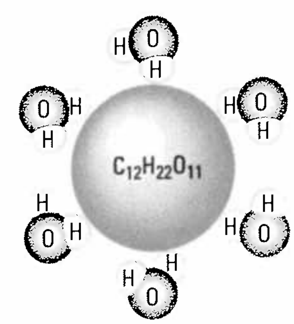
Ionic Compounds in Water

Water is the most important solvent on Earth. The oceans, lakes, rivers, and rain are aqueous solutions containing many different ionic compounds and a few molecular solutes. As you know, there are some ionic compounds that dissolve only very slightly in water, such as limestone (calcium carbonate) buildings and various other rocks and minerals. Nevertheless, many more ionic compounds dissolve in water than in any other known solvent.

Why are ionic compounds so soluble in water? The key to the explanation came from the study of electrolytes. Electrolytes were first explained by Svante Arrhenius who was born in Wijk, Sweden, in 1859. While attending the University of Uppsala, he became intrigued by the problem of how and why some aqueous solutions conduct electricity, but others do not. This problem had puzzled chemists ever since Sir Humphry Davy and Michael Faraday experimented over half a century earlier by passing electric currents through chemical substances.

Faraday believed that an electric current produces new charged particles in a solution. He called these electric particles ions (a form of the Greek word for "to go"). He could not explain what ions were, or why they did not form in solutions of substances such as sugar or alcohol dissolved in water.

In 1887 Arrhenius proposed a new hypothesis: that particles of a substance, when dissolving, separate from each other and disperse into the solution. Nonelectrolytes disperse electrically neutral particles throughout the solution. As Figure 7 shows, molecules of sucrose (a nonelectrolyte) separate from each other



$C_{12}H_{22}O_{11(s)} \longrightarrow C_{12}H_{22}O_{11(aq)}$

Figure 7
This model illustrates sucrose dissolved in water. The model, showing electrically neutral particles in solution, agrees with the evidence that a sucrose solution does not conduct electricity.