

## Lesson Check Answers

1. Water molecules are hydrogen bonded to each other but not to air molecules. Net attraction is inward, minimizing the water surface area. Hydrogen bonding makes it more difficult for water molecules to escape from the liquid phase to the vapor phase.
2. Ice has a honeycomb-like structure of water molecules.
3. The surface tension of a liquid tends to hold a drop of liquid in a spherical shape.
4. Surfactants lower the surface tension of water by interfering with hydrogen bonding.
5. Water has intermolecular hydrogen bonding between its molecules; methane does not.
6. Water expands as it freezes.
7. Water molecules at the surface of a water drop are drawn into the body of the liquid producing water's unusually high surface tension. Hydrogen bonds also hold water molecules to one another resulting in water's unusually low vapor pressure.

## Sample Problems

8. Find the molar mass of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$   
 $\text{Cu}$  (63.5 g/mol) +  $\text{S}$  (32.1 g/mol) +  $\text{O}$  (4 x 16.0 g/mol) +  $\text{H}_2\text{O}$  (5 x 18.0 g/mol)  
 = 249.6 g/mol  
 $\text{H}_2\text{O}$  (5 x 18 g/mol) / 249.5 g/mol = 36.1%
9. Find the molar mass of  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$   
 $\text{Na}$  (2 x 23.0 g/mol) +  $\text{C}$  (12.0 g/mol) +  $\text{O}$  (3 x 16.0 g/mol) +  $\text{H}_2\text{O}$  (10 x 18.0 g/mol)  
 = 286 g/mol  
 $\text{H}_2\text{O}$  (10 x 18.0 g/mol) / 286 g/mol = 62.9%  
 This means the anhydrous compound comprises 37.1% of the hydrate.  
 5.00 g represents 37.1% of the hydrate;  $X \times 37.1\% = 5.00 \text{ g}$   
 $X = 13.5 \text{ g}$  of the hydrate ( $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ )

**FIGURE 15.15** The solvent is water and the solute is sodium hydroxide.

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10. Ionic compounds and polar covalent compounds
11. They dissociate into ions.
12. The forces holding the water molecules in hydrates are not very strong, so the water is easily lost and regained.
13. The solute is acetic acid. The solvent is water.
14. 46%
15. The percents of copper in copper sulfate and copper sulfate pentahydrate are different because the formula masses of the two compounds are different.
16. Efflorescent compounds such as certain hydrates lose water to the air. Hygroscopic compounds remove moisture from air, sometimes forming hydrates.
17.
  - a. insoluble, nonpolar
  - b. soluble, ionic
  - c. insoluble, nonpolar
  - d. soluble, ionic
  - e. soluble, polar
  - f. soluble, ionic

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18. The particles of a suspension are much larger and do not stay suspended indefinitely.
19. Colloids have particles smaller than those in suspensions and larger than those in solutions.
20. The particles in a suspension will settle out over time.
21. Particles in a colloid such as gelatin are smaller than the holes in filter paper and cannot be removed by filtering.
22. A beam of light is visible as it passes through a colloid; a beam of light is invisible as it passes through a solution.
23. Flashes of light, or scintillations, are seen when colloids are studied under a microscope. Colloids scintillate because the particles move erratically. The particles in a solution are too small to be seen under a microscope and do not cause scintillations.