SECTION C SUMMARY

Section C Supplement

Reviewing the Concepts

1. The solubility of sugar in water increases as the temperature of the water increases.
2. Referring to **Figure 1.33**, the maximum is ~ 48 g.
3. a. $\frac{2.0\text{ g sugar}}{1\text{ mL water}} \times 100.0\text{ mL water} =$ 200 g sugar
   b. 710 g sugar
   c. 1900 g sugar
4. a. At 20 °C: NaCl, KCl, KNO_3
   b. At 80 °C: KNO_3, KCl, NaCl
5. A saturated solution contains the maximum quantity of solute that can be dissolved in a stable solution at that temperature, while an unsaturated solution is any solution that contains less than that maximum quantity of solute.
6. a. About 32 g
   b. At 30 °C, approximately 45 g KNO_3 will normally dissolve in 100 g water, so this solution is supersaturated.
   c. At 75 °C, 150 g KNO_3 will dissolve. At 40 °C, a saturated solution contains about 60 g KNO_3. The difference, 150 g − 60 g = 90 g, indicates the mass of precipitate that will form.
7. a. The crystal will dissolve (stirring may be required).
   b. The crystal will probably settle to the container bottom.
   c. The crystal will initiate crystallization of "excess" solute.
8. $\frac{35\text{ g ethanol}}{(115\text{ g water} + 35\text{ g ethanol})} \times 100\% = 23\%$ ethanol by mass

SECTION C SUMMARY Key 5

Reviewing the Concepts

The solubility of a substance in water can be expressed as the quantity of that substance that will dissolve in a certain quantity of water at a specified temperature.

1. Explain why three teaspoons of sugar will completely dissolve in a serving of hot tea, but will not dissolve in an equally sized serving of iced tea.
2. What is the maximum mass of potassium chloride (KCl) that will dissolve in 100.0 g water at 70 °C?
3. If the solubility of sugar (sucrose) in water i 2.0 g/mL at room temperature, what is the r imum mass of sugar that will dissolve in
   a. 100.0 mL water?
   b. 355 mL (12 oz) water?
   c. 946 mL (1 qt) water?
4. Rank the substances in Figure 1.33 (page from most soluble to least soluble at
   a. 20 °C. b. 80 °C.

Solutions can be classified as unsaturated, saturated, or supersaturated. In quantitative terms, the concentration of a solution expresses the relative quantities of solute and solvent in a particular solution.

5. Distinguish between the terms *saturated* and *unsaturated*.
6. Using the graph on page 54, answer these questions about the solubility of potassium nitrate, KNO_3:
   a. What maximum mass of KNO_3 can dissolve in 100 g water if the water temperature is 20 °C?
   b. At 30 °C, 55 g KNO_3 is dissolved in 100 g water. Is this solution saturated, unsaturated, or supersaturated?
   c. A saturated solution of KNO_3 is formed in 100.0 g water at 75 °C. If some solute precipitates as the saturated solution cools to 40 °C, what mass (in grams) of solid KNO_3 should form?
7. You are given a solution of KNO_3 of unkn concentration. What will happen when y add a crystal of KNO_3, if the solution is
   a. unsaturated? b. saturated?
   c. supersaturated?
8. A 35-g sample of ethanol is dissolved in 1 water. What is the percent concentration the ethanol, expressed as percent ethanol mass?
9. Calculate the masses of water and sugar i 55.0-g sugar solution that is labeled 20.0% sugar by mass.
10. The EPA maximum standard for lead in drinking water is 0.015 mg/L. Express thi value as parts per million (ppm).

The polarity of water helps explain its ability to dissolve many ionic solids.

11. What makes a water molecule polar?
12. Draw a model that shows how molecules in liquid water generally arrange themselves relative to one another.
13. Which region of a polar water molecule be attracted to a
    a. K^+ ion? b. Br^- ion?

9. $\frac{20.0\text{ g sugar}}{100.0\text{ g solution}} \times 55.0\text{ g solution} =$ 11.0 g sugar
   55.0 g solution − 11.0 g sugar = 44.0 g water
10. $\frac{0.015\text{ mg lead}}{1\text{ L water}} \times \frac{1\text{ L water}}{1000\text{ g water}} \times \frac{1\text{ g water}}{1000\text{ mg water}} = \frac{0.015\text{ mg le}}{1\ 000\ 000\text{ mg}}$
    0.015 ppm lead
11. Unequal electrical charge distrib The oxygen end is more negativ hydrogen ends are more positiv
12. Molecules are close to each other, with the H end of one molecule adjacent to the O end of another.
13. a. The oxygen region
    b. The hydrogen region