SAMPLE PROBLEM E

A solution of iodine, I_2, in carbon tetrachloride, CCl_4, is used when iodine is needed for certain chemical tests. How much iodine must be added to prepare a 0.480 *m* solution of iodine in CCl_4 if 100.0 g of CCl_4 is used?

SOLUTION

1 ANALYZE

Given: molality of solution = 0.480 *m* I_2
mass of solvent = 100.0 g CCl_4

Unknown: mass of solute

2 PLAN

Your first step should be to convert the grams of solvent to kilograms. The molality gives you the moles of solute, which can be converted to the grams of solute using the molar mass of I_2.

3 COMPUTE

Use the periodic table to compute the molar mass of I_2.
$I_2 = 253.8$ g/mol

$$100.0 \text{ g } \cancel{CCl_4} \times \frac{1 \text{ kg}}{1000 \text{ g } \cancel{CCl_4}} = 0.100 \text{ kg } CCl_4$$

$$0.480\ m = \frac{x \text{ mol } I_2}{0.1 \text{ kg } H_2O} \qquad x = 0.0480 \text{ mol } I_2$$

$$0.0480 \text{ } \cancel{\text{mol } I_2} \times \frac{253.8 \text{ g } I_2}{\cancel{\text{mol } I_2}} = 12.2 \text{ g } I_2$$

4 EVALUATE

The answer has three significant digits and the units for mass of I_2.

PRACTICE

Answers in Appendix E

1. What is the molality of acetone in a solution composed of 255 g of acetone, $(CH_3)_2CO$, dissolved in 200. g of water?
2. What quantity, in grams, of methanol, CH_3OH, is required to prepare a 0.244 *m* solution in 400. g of water?

extension
Go to **go.hrw.com** for more practice problems that ask you to calculate molality.
Keyword: HC6SLNX

SECTION REVIEW

1. What quantity represents the ratio of the number of moles of solute for a given volume of solution?
2. We dissolve 5.00 grams of sugar, $C_{12}H_{22}O_{11}$, in water to make 1.000 L of solution. What is the concentration of this solution expressed as a molarity?

Critical Thinking

3. **ANALYZING DATA** You evaporate all of the water from 100. mL of NaCl solution and obtain 11.3 grams of NaCl. What was the molarity of the NaCl solution?
4. **RELATING IDEAS** Suppose you know the molarity of a solution. What additional information would you need to calculate the molality of the solution?