

Currently, air and water contaminants, drugs in the human body, and pesticide residues are measured in parts per million.

Example 14.2

What is the mass percent of sodium hydroxide in a solution that is made by dissolving 8.00 g NaOH in 50.0 g H₂O?

SOLUTION

READ **Knowns** 8.00 g NaOH
50.0 g H₂O

Solving for: mass percent

CALCULATE
$$\left(\frac{8.00 \text{ g NaOH}}{8.00 \text{ g NaOH} + 50.0 \text{ g H}_2\text{O}} \right) = 13.8\% \text{ NaOH solution}$$

Example 14.3

What masses of potassium chloride and water are needed to make 250. g of 5.00% solution?

SOLUTION

READ **Knowns** 250. g solution
5.00% solution

Solving for: masses KCl and water

PLAN 5.00% of 250. g = (0.0500)(250. g) = 12.5 g KCl (solute)

CALCULATE 250. g - 12.5 g = 238 g H₂O
Dissolving 12.5 g KCl in 238 g H₂O gives a 5.00% solution.

Example 14.4

A 34.0% sulfuric acid solution had a density of 1.25 g/mL. How many grams of H₂SO₄ are contained in 1.00 L of this solution?

SOLUTION

READ **Knowns** $d = 1.25 \text{ g/mL}$
 $V = 1.00 \text{ L}$
34.0% H₂SO₄ solution

Solving for: mass H₂SO₄

PLAN Find the mass of the solution from the density and then use the mass percent to determine the mass of H₂SO₄.

CALCULATE $d = \text{mass}/V$

$$\text{mass of solution} = \left(\frac{1.25 \text{ g}}{\text{mL}} \right) (1.00 \times 10^3 \text{ mL}) = 1250 \text{ g (solution)}$$

$$\text{mass percent} = \left(\frac{\text{g solute}}{\text{g solution}} \right) 100$$

$$\text{g solute} = \frac{(\text{mass percent})(\text{g solution})}{100}$$

Practice 14

What is the mass percent of Na₂SO₄ in 225.0 g of solution?

Mass/Volume Percent

This method expresses the concentration of a solution in terms of mass of solute per volume of solution. For example, a 10.0% NaCl solution means 10.0 g of NaCl is dissolved in 100 mL of solution. To prepare a 5.00% solution, 5.00 g of solute is dissolved in 100 mL of solution. To dilute a 20.0% solution to a 5.00% solution, 20.0 g of solute is diluted to 400 mL of solution.

mass/volume percent

Example 14.5

A 3.0% H₂O₂ solution is used to disinfect a wound. What volume of this solution is needed to provide 1.0 g of H₂O₂?

SOLUTION First, find the mass of H₂O₂ in 100 mL of solution.

Volume Percent

Solutions that are concentrated in terms of volume are expressed in volume percent. For example, a 70% by volume solution of isopropyl alcohol means 70 mL of isopropyl alcohol is dissolved in 100 mL of solution. To make a 50% by volume solution, 50 mL of isopropyl alcohol is dissolved in 100 mL of solution.

volume percent

Volume percent is commonly used for solutions of liquids in liquids. For example, 40% by volume ethanol means 40 mL of ethanol is dissolved in 100 mL of solution. Scotch whiskey is 40% by volume ethanol.

Molarity

Mass percent solution is a ratio of mass of solute to mass of solution. For example, a 10.0% NaCl solution means 10.0 g of NaCl is dissolved in 100 g of solution.