Self-Check 16
Mixture and Concentration Problems

1. How many kilograms of water must be evaporated from 8 kg of a 25% salt solution to produce a 40% salt solution?

2. What mass of CO_2 is required to prepare 1 liter of a 1M CO_2 solution?

3. A 75.80 g sample of NaCl is dissolved in 250 mL of solution. Calculate the molarity of this solution.

4. A chemistry experiment requires a 20% sulfuric acid solution. If the lab supply room has only 50% and 10% sulfuric acid solutions available, how much of each should be mixed to obtain 12 liters of a 20% solution?

Solutions for Self-Check 16
Mixture and Concentration Problems

1. How many kilograms of water must be evaporated from 8 kg of a 25% salt solution to produce a 40% salt solution?

   Let *x* represent mass of water with required concentration. Set up the following equation using indirect proportion (concentration increases as mass decreases) and solve for *x*.

   $$\text{Mass}_1 \cdot \text{Concentration}_1 = \text{Mass}_2 \cdot \text{Concentration}_2$$

   $$8\ (.25) = x\ (.4)$$

   Therefore, $x = 5$ kg is the required mass and 3 kg of water must be evaporated to obtain the 40% solution.

2. What **mass** of CO_2 is required to prepare 1 liter of a 1M CO_2 solution?

   Since C ≈ 12.01 g/mol and O ≈ 16 g/mol, the mass of CO_2 is approximately 12.01 + 32 or 44 grams using significant figures.

3. A 75.80 g sample of NaCl is dissolved in 250 mL of solution. Calculate the molarity of this solution.

   Step 1. Find NaCl's molecular weight.

   Molecular weight NaCl = 58.443 g

   Step 2. Find number of moles of NaCl.

   75.80 g · (1 mol/58.443 gram) = 1.297212192 mol

   Step 3. Use Step 2 answer to find molarity.

   M = mol/L

   M = (1.297212192 mol/ 250mL) · (1000 mL/1L) ≈ 5.188848767

   Using significant figures the molarity of this solution is 5.2 M.

Solutions for Self-Check 16
Mixture and Concentration Problems

4. A chemistry experiment requires a 20% sulfuric acid solution. If the lab supply room has only 50% and 10% sulfuric acid solutions available, how much of each should be mixed to obtain 12 liters of a 20% solution?

   Let x represent the number of liters of 50% solution and y represent the number of liters of 10% solution to be used.

   Equation 1: $x + y = 12$. Solving for y, $y = 12 - x$.

   Equation 2: $(.5)\,x + (.1)\,y = (.2)\,(12)$

   In Equation 2, replace y with $12 - x$. Solve for x and calculate y.

   $$\mathbf{(.5)\,x + (.1)\,(12 - x) = (.2)\,(12)}$$

   Therefore, $x = 3$ and $y = 9$. To make 12 liters of a 20% sulfuric acid solution, mix 3 liters of the 50% solution with 9 liters of the 10% solution.