

GENERAL CHEMISTRY

STANDARD 10.5

DEFINITIONS

- **Molarity:** The number of moles of solute dissolved per liter of solution
 - One of the most common quantitative measures of solution concentration

$$M = \frac{n}{V}$$

EXAMPLE

- Suppose you dissolve one mole of sucrose (about 342.3 g) into one liter of water. What is the molarity of the sugar water solution?
 - This one is easy...1.0 M
- What is the molarity of a solution created by dissolving 45 g of NaCl into 450 mL of water?
 - First, convert the 45 g of NaCl to moles of NaCl:

$$\frac{45 \text{ g NaCl}}{58.4 \text{ g NaCl}} \times \frac{1 \text{ mol NaCl}}{1 \text{ mol NaCl}} = 0.771 \text{ mol NaCl}$$

- Now, convert the 450 mL of water into liters:

$$\frac{450 \text{ mL water}}{1000 \text{ mL}} \times \frac{1 \text{ L water}}{1 \text{ L water}} = 0.45 \text{ L water}$$

- Now use the five step problem solving method

EXAMPLE CONTINUED

Step 1

$$\begin{aligned}n &= 0.771 \text{ mol NaCl} \\V &= 0.45 \text{ L} \\M &= ?\end{aligned}$$

Step 2

$$M = \frac{n}{V}$$

Step 3

$$M = \frac{n}{V}$$

Step 4

$$M = \frac{0.771 \text{ mol}}{0.45 \text{ L}}$$

Step 5

$$M = 1.7 \text{ M}$$

ANOTHER EXAMPLE

- What mass of sodium nitrate (NaNO_3) is dissolved in a 250. mL solution with a concentration of 3.50 M?
 - First, convert the 250. mL to L \rightarrow 0.250 L of solution
 - Now use the five step problem solving method, solving for number of moles n:

Step 1

$$\begin{aligned} n &= ? \\ V &= 0.250 \text{ L} \\ M &= 3.50 \text{ M} \end{aligned}$$

Step 2

$$M = \frac{n}{V}$$

Step 3

$$M \times V = n$$

Step 4

$$3.50 \text{ M} \times 0.250 \text{ L} = n$$

Step 5

$$n = 0.875 \text{ moles}$$

Now convert $n = 0.875$ moles of sodium nitrate to grams:

$$\frac{0.875 \text{ mol NaNO}_3}{1} \times \frac{85.0 \text{ g NaNO}_3}{1 \text{ mol NaNO}_3} = 74.4 \text{ g NaNO}_3$$

TRY IT YOURSELF

- 80.0 grams of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) is dissolved in enough water to make 1.00 L of a solution. What is its molarity?
- When 2.00 g of KMnO_4 is dissolved into 100.0 mL of solution, what is the molarity?
- How many mL of solution will result when 15.0 g of H_2SO_4 is dissolved to make a 0.200 M solution?

TRY IT YOURSELF SOLUTIONS

- 80.0 grams of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) is dissolved in enough water to make 1.00 L of a solution. What is its molarity?

0.444 M

- When 2.00 g of KMnO_4 is dissolved into 100.0 mL of solution, what is the molarity?

0.127 M

- How many mL of solution will result when 15.0 g of H_2SO_4 is dissolved to make a 0.200 M solution?

765 mL