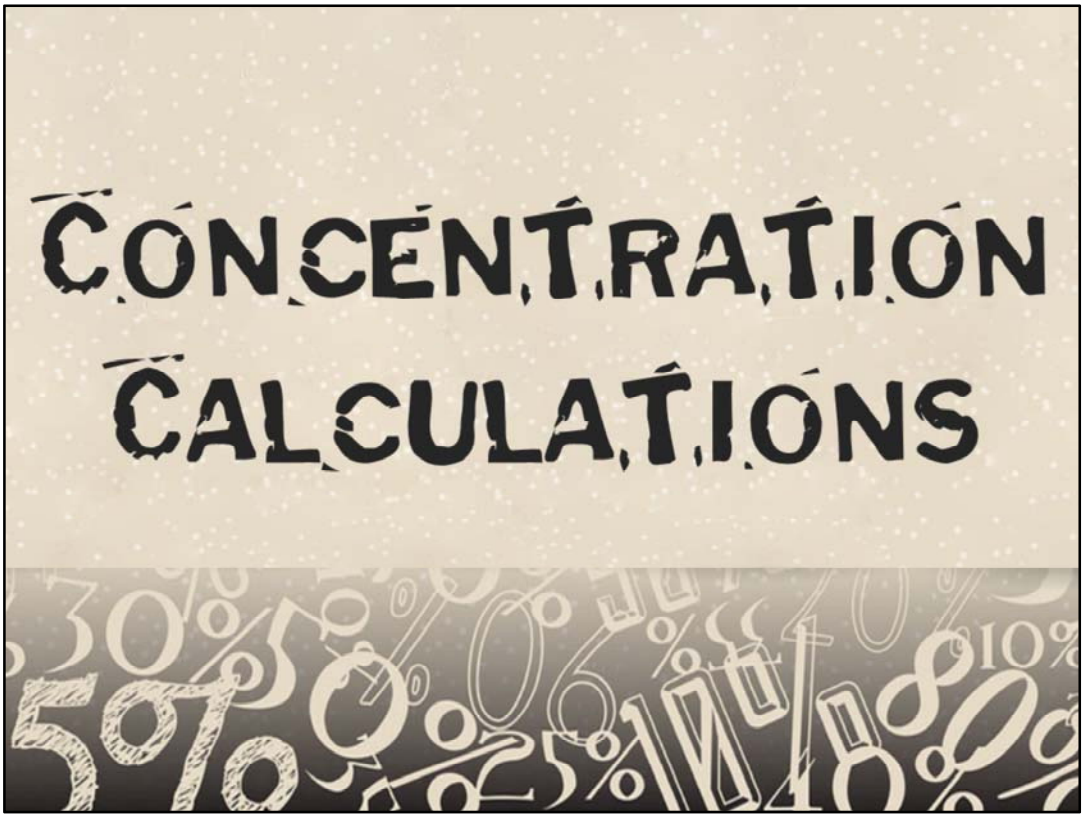
Module 10: Solutions

Topic 3 Content: Concentration Calculations Presentation Notes



Concentration Calculations

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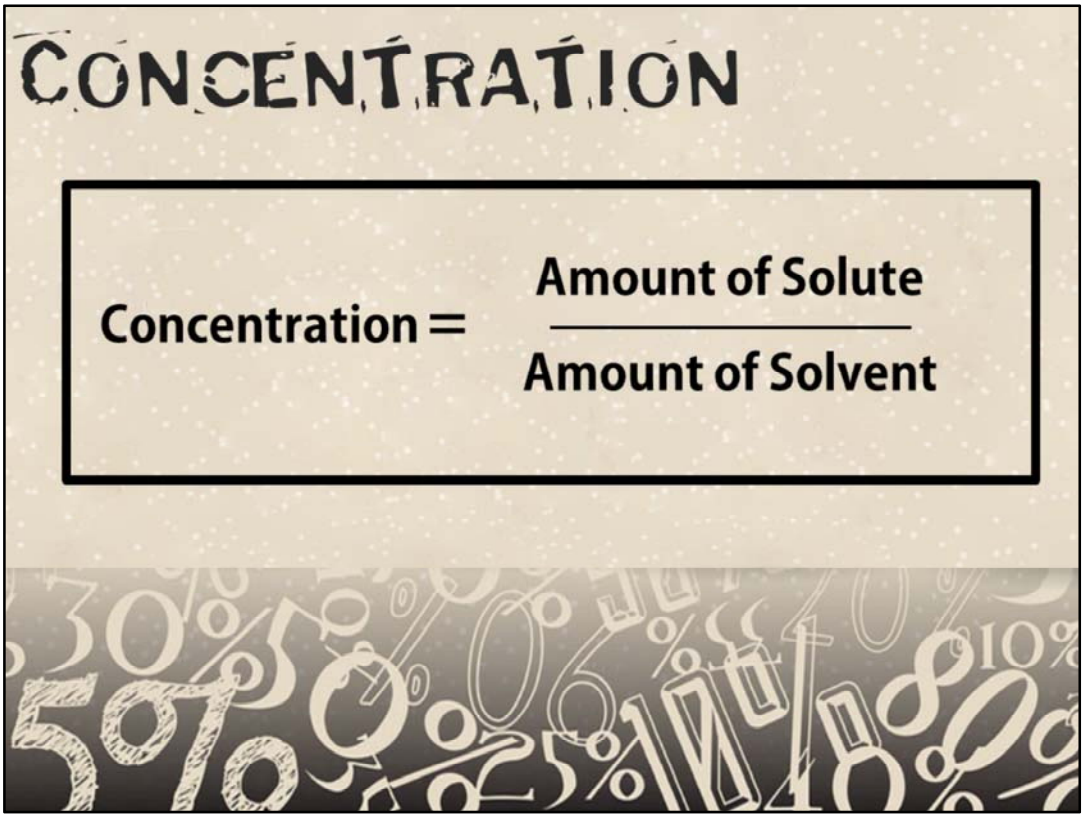

Solutions can be composed of a solid, liquid, or gas dissolved in water. The concentration of a solution is the ratio of the amount of solute compared to the amount of solvent. You can view this ratio in the equation shown here. While concentrations are expressed in many ways, each one is just a different method of measuring the amount of solute or solvent.

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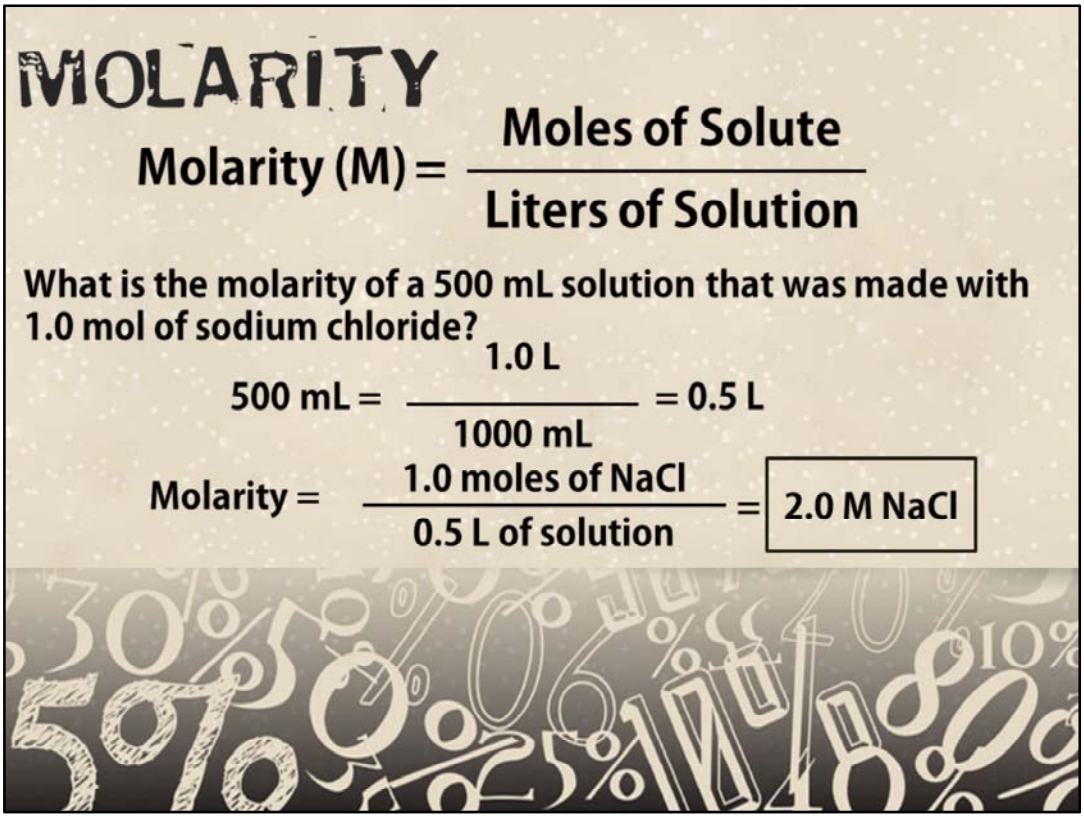
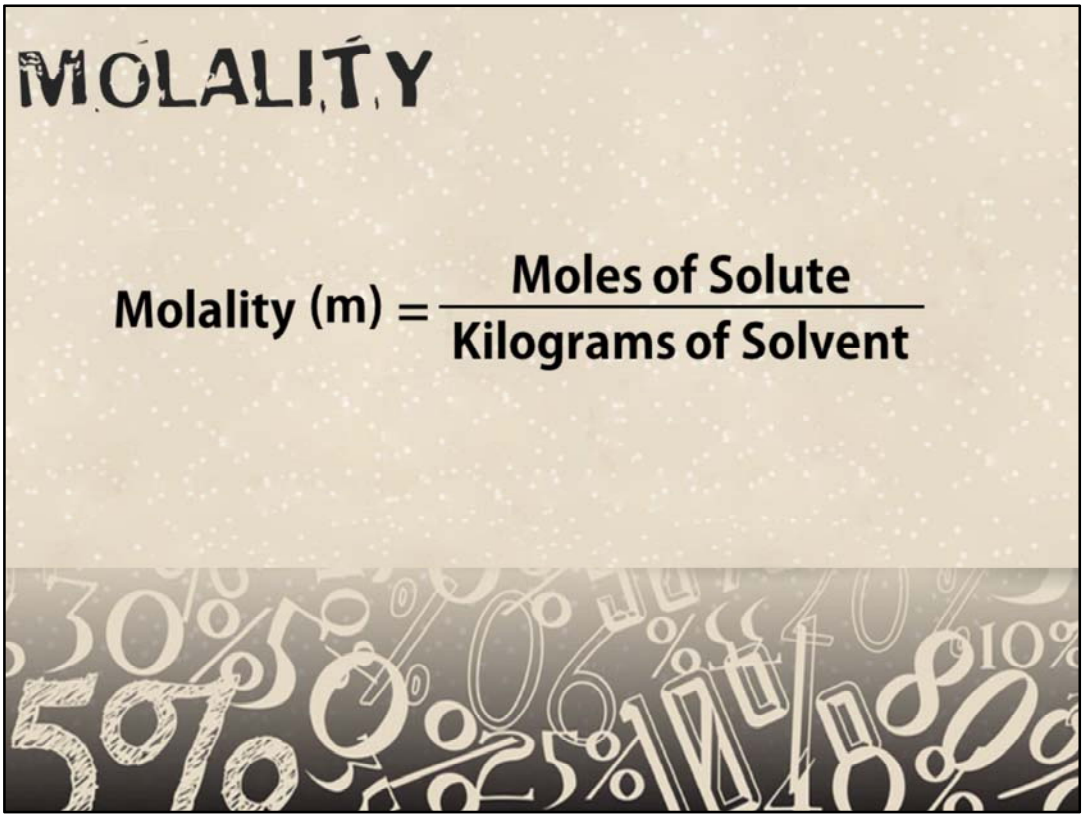


Molarity is defined as the number of moles of solute in one liter of solution. The abbreviation for molarity is M. To solve for molarity, you divide the moles of solute by the liters of solution. Take a moment to review this example problem.

What is the molarity of a 500 mL solution that was made with 1.0 mol of sodium chloride?

To figure out the molarity of this solution you must use the molarity equation. Since the denominator asks for liters, you will need to convert 500 mL to liters. After the conversion, use the molarity equation to divide 1.0 mol of NaCl by 0.5 liters of solution. You should find that 2.0 moles of NaCl exist in this solution.



Calculations in molality are similar to molarity except that it is the number of moles of solute in one kilogram of solvent. Since 1000 g of water is equal to 1000 mL of water, if water is the solvent, then the calculation is exactly the same. Not all solvents are the same as water. For other solvents, molarity and molality are different. The abbreviation for molality is m.

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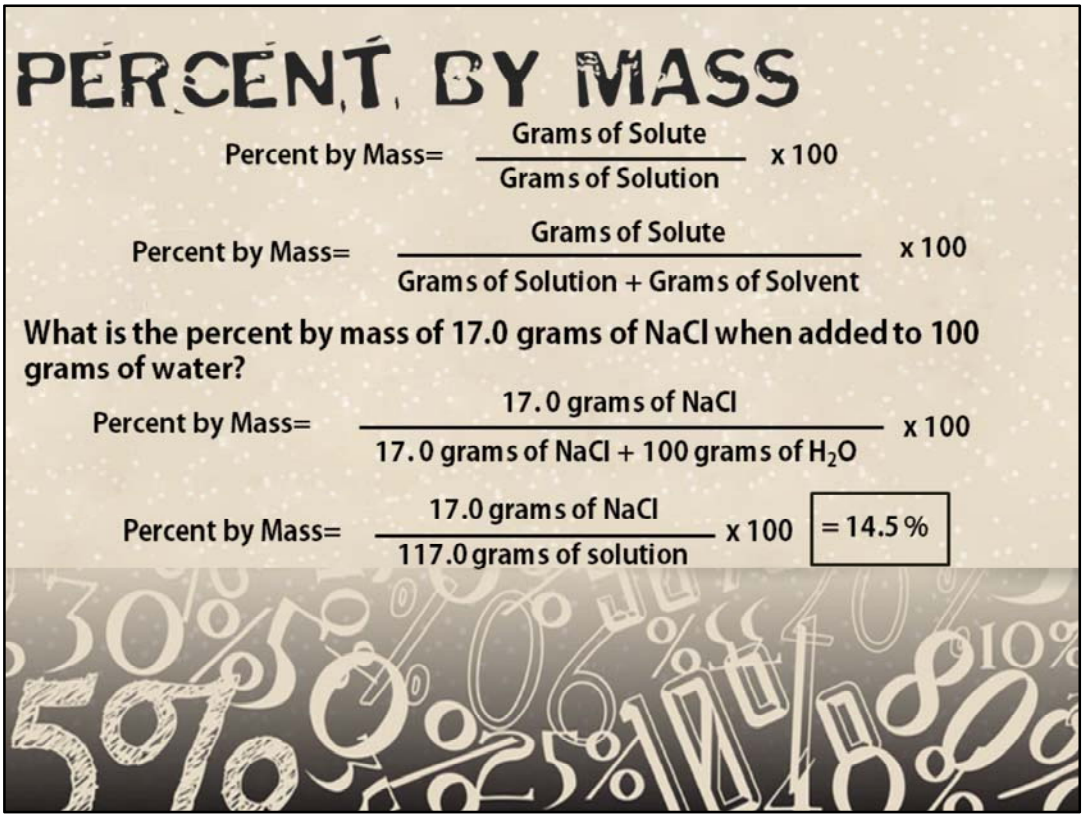

Percent by mass is the ratio of the mass of solute compared to the mass of solution times 100. When you are solving this calculation, make sure that the denominator includes the mass of the entire solution. You need to include the grams of solution and solvent in your calculations. Take a moment to review this example problem.

What is the percent by mass of 17.0 grams of NaCl when added to 100 grams of water?

To solve for percent by mass, divide the grams of solute by the grams of solution. In the example problem, the grams of solute is equal to 17.0 grams of NaCl. The total amount of grams in the solution is 117.0 grams. To calculate the percent by mass, divide 17.0 grams of NaCl by 117.0 grams of solution. Next, multiply by 100 to achieve the percent by mass. The percent by mass is 14.5%.

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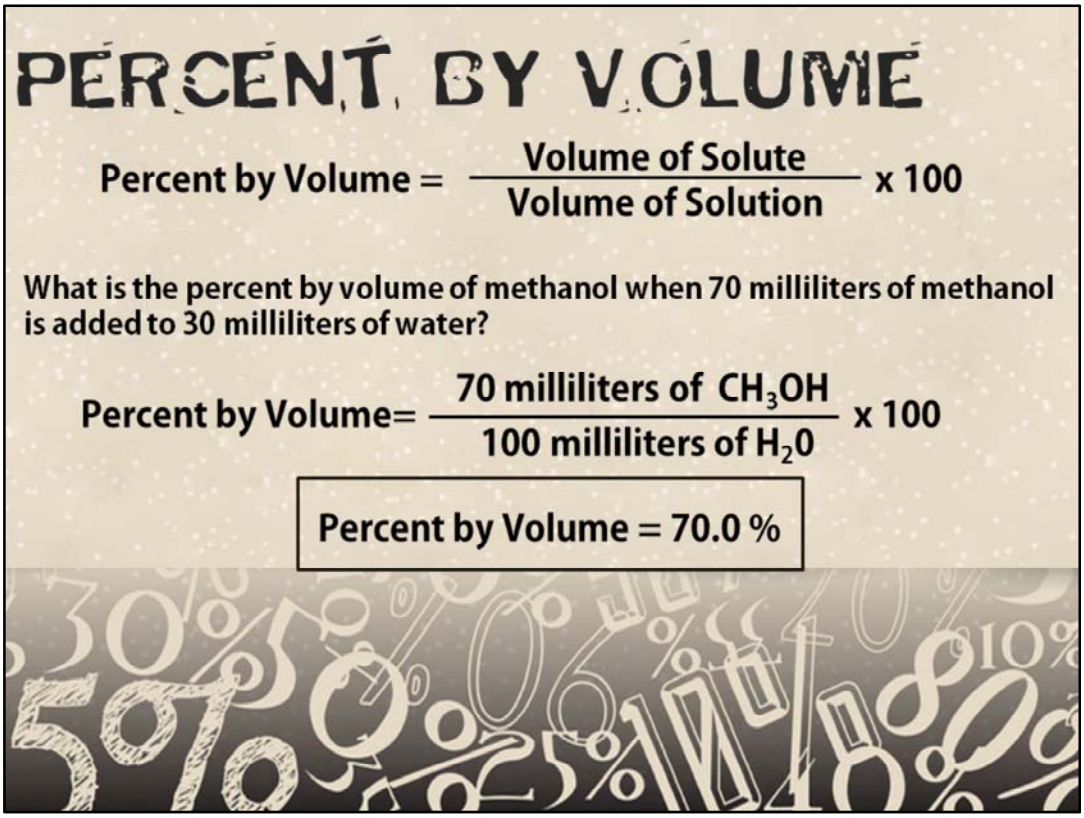

The percent by volume is calculated when two liquids are mixed. This calculation is also known as volume percentage. Take a moment to review this example problem.

What is the percent by volume of methanol when 70 milliliters of methanol is added to 30 milliliters of water?

To solve this problem, use the percent by volume equation. This calculation is identical to the percent by mass calculation. To solve this calculation, you will divide the volume of the solute by the volume of the solution. Lastly, multiply the decimal by 100 to achieve the percent by volume. The example problem has a percent by volume of 70.0%.