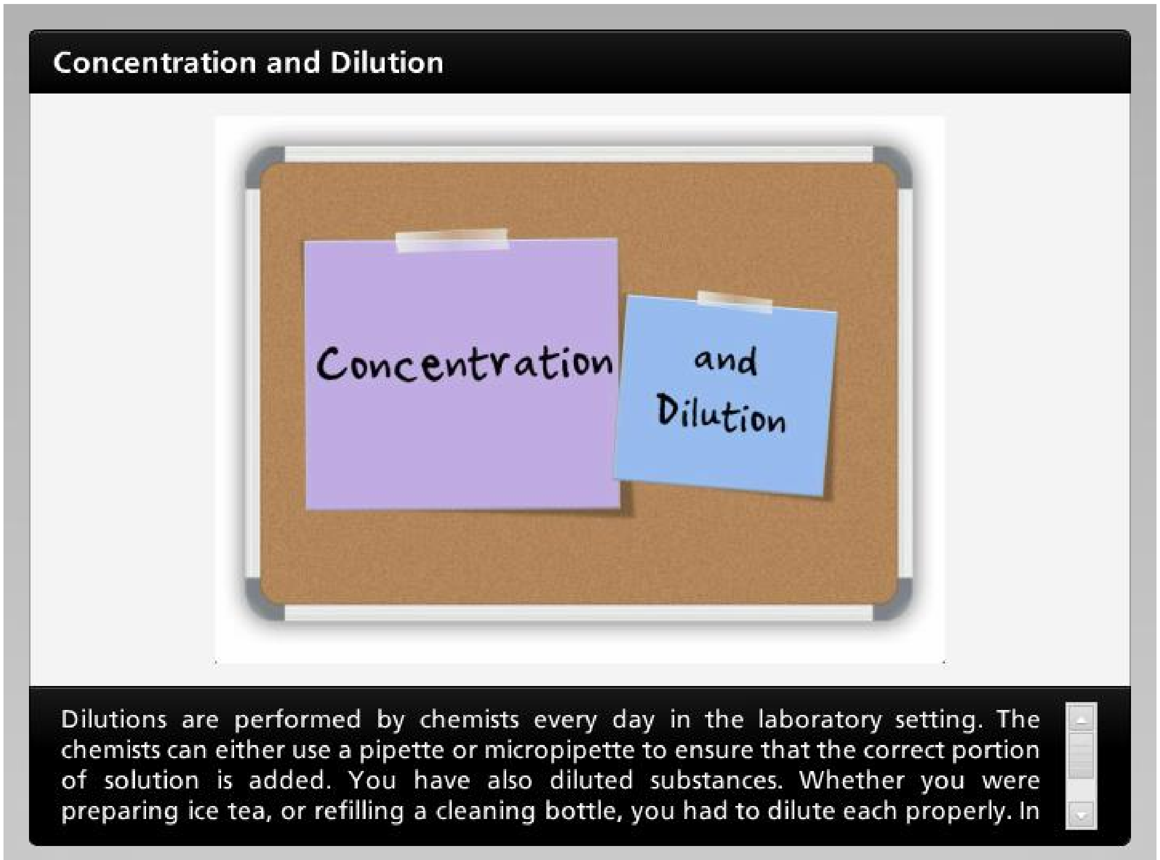
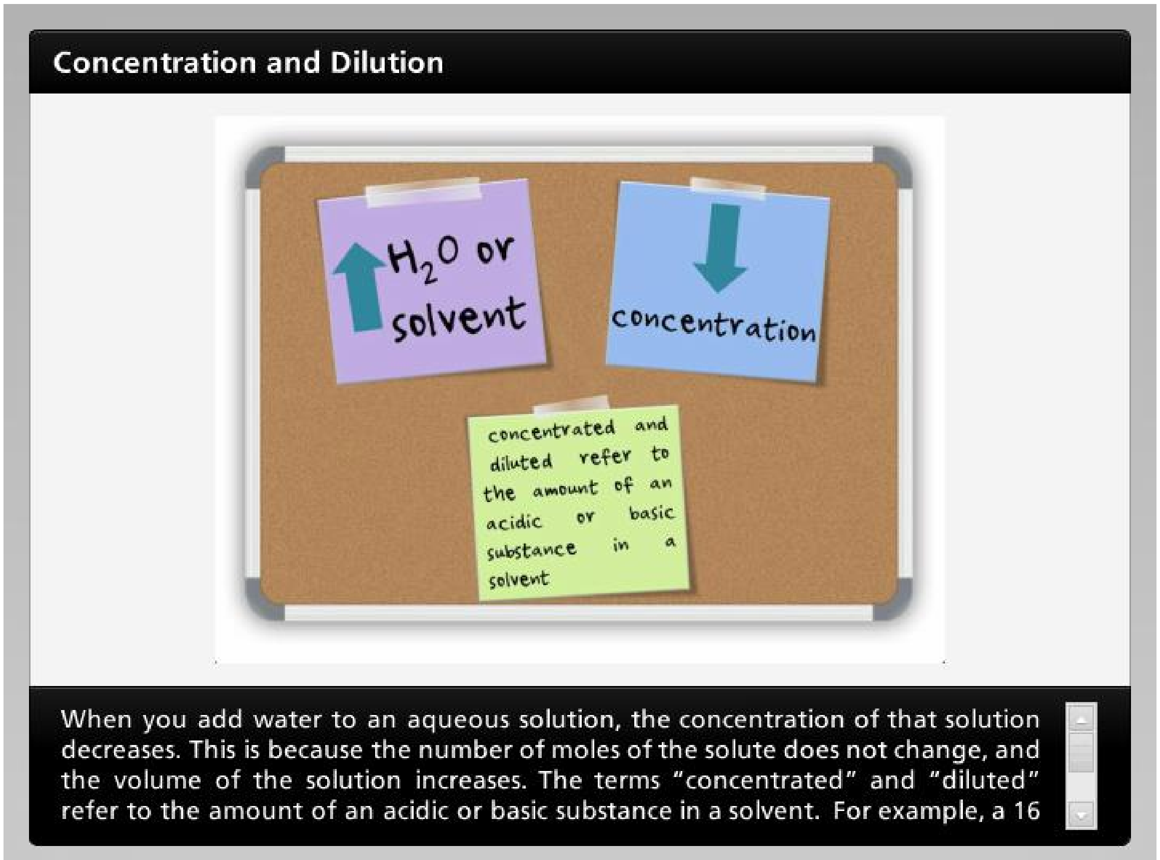
Module 10: Solutions
Topic 4 Content: Concentration and Dilution Notes



Dilutions are performed by chemists every day in the laboratory setting. The chemists can either use a pipette or micropipette to ensure that the correct portion of solution is added. You have also diluted substances. Whether you were preparing ice tea, or refilling a cleaning bottle, you had to dilute each properly. In this interactivity, use the ***NEXT*** and ***PREV*** buttons in the lower right corner to learn more about dilution and concentration.



When you add water to an aqueous solution, the concentration of that solution decreases. This is because the number of moles of the solute does not change, and the volume of the solution increases. The terms “concentrated” and “diluted” refer to the amount of an acidic or basic substance in a solvent. For example, a 16 M solution of hydrochloric acid is more concentrated than a 0.5 solution of the same acid because it has a higher molarity. Even solutions, like drink mixes and iced tea, can be referred to as concentrated or diluted.

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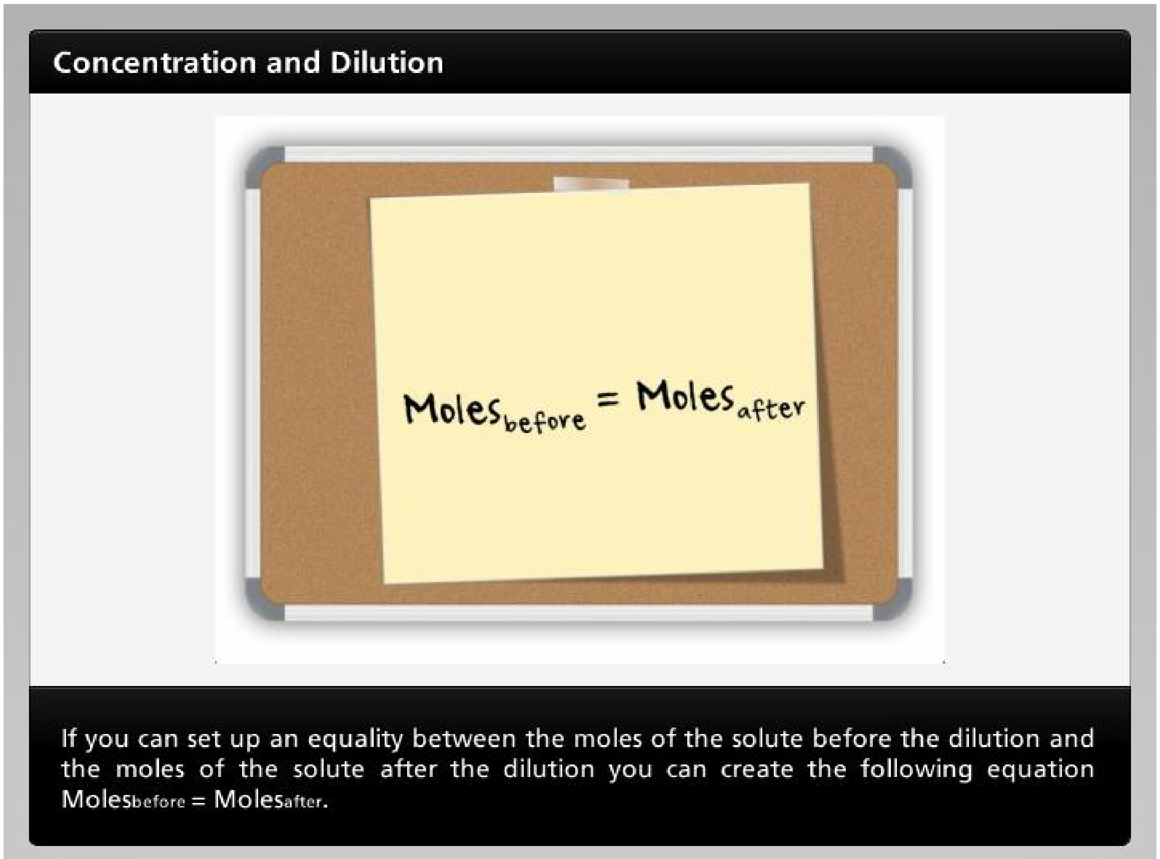

If you can set up an equality between the moles of the solute before the dilution and the moles of the solute after the dilution you can create the following equation $\text{Moles}_{before} = \text{Moles}_{after}$.

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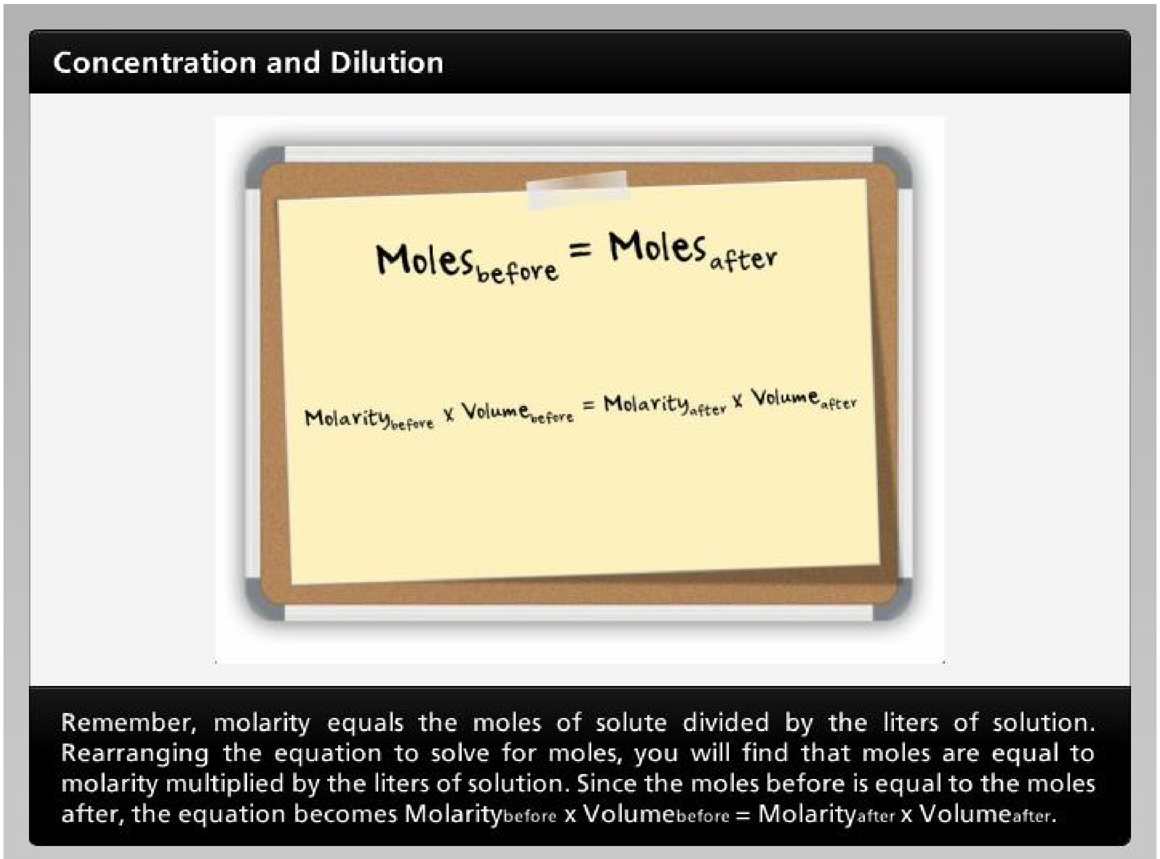
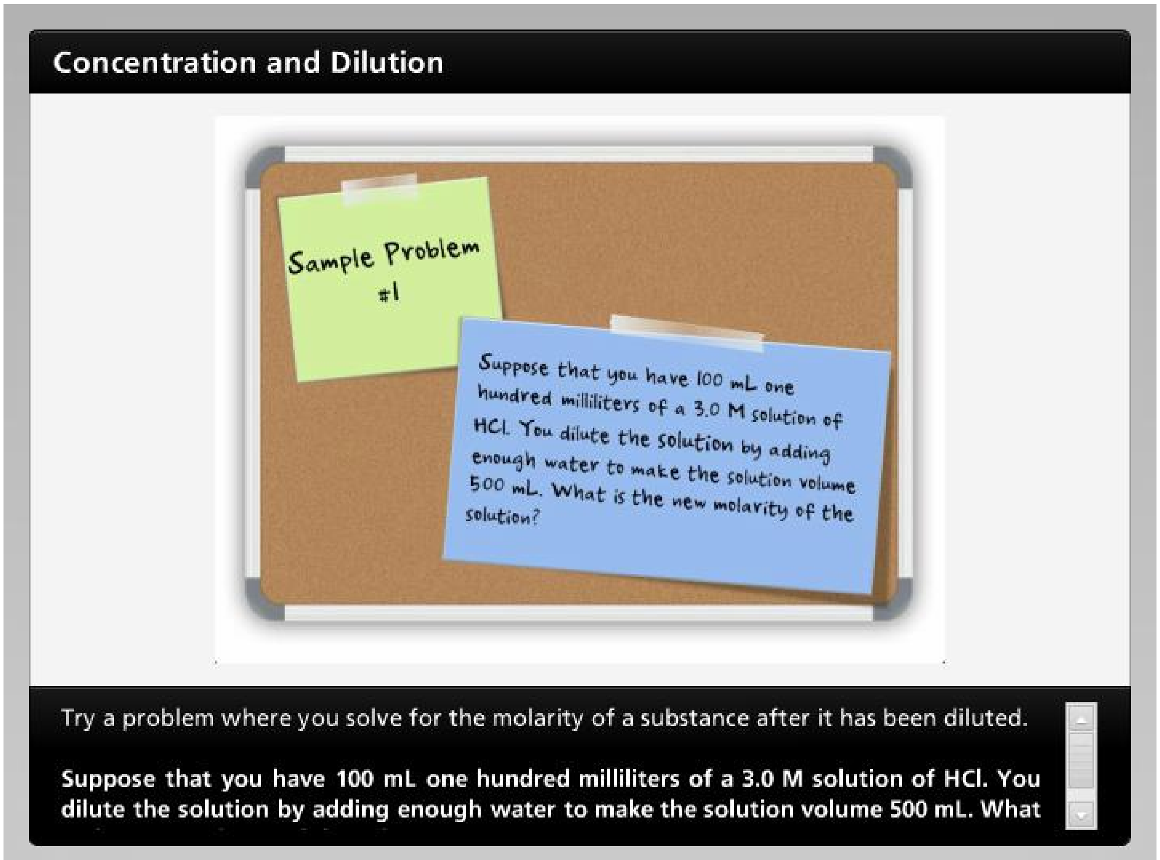
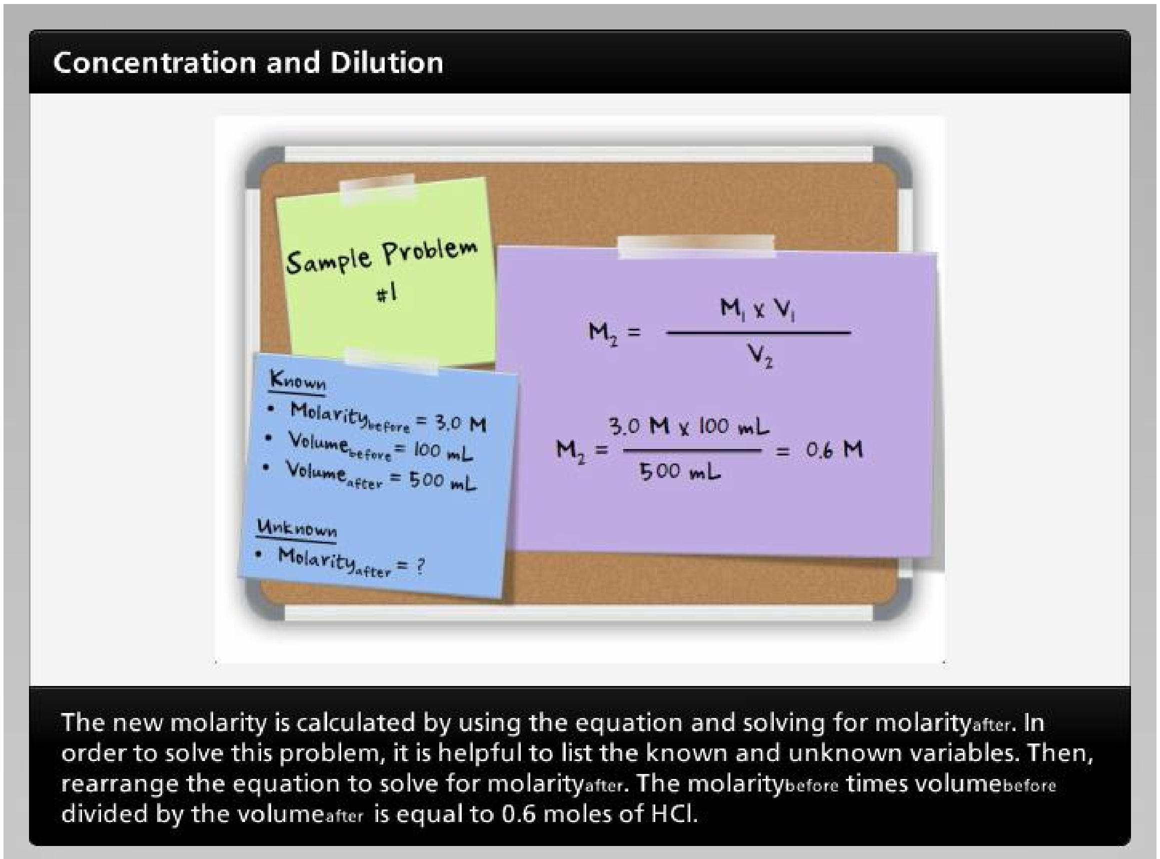


Remember, molarity equals the moles of solute divided by the liters of solution. Rearranging the equation to solve for moles, you will find that moles are equal to molarity multiplied by the liters of solution. Since the moles before is equal to the moles after, the equation becomes $\text{Molarity}_{\text{before}} \times \text{Volume}_{\text{before}} = \text{Molarity}_{\text{after}} \times \text{Volume}_{\text{after}}$.

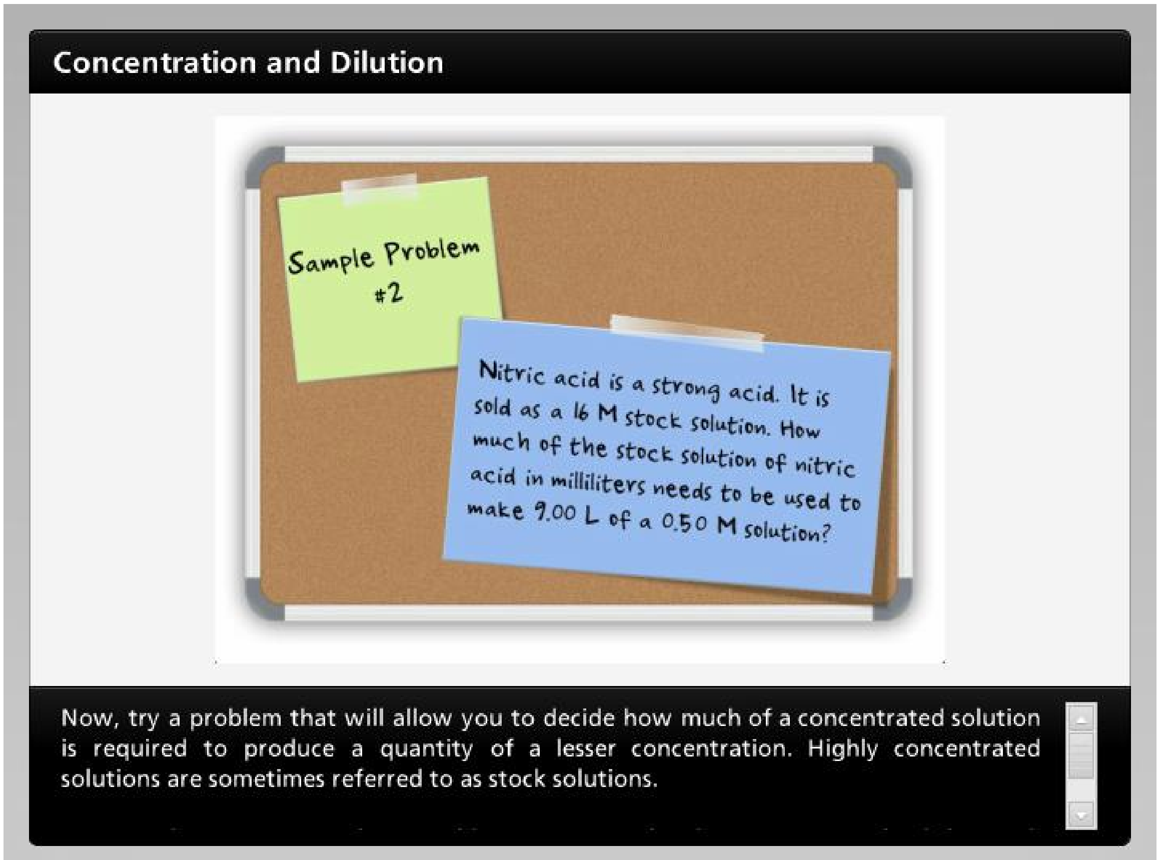


Try a problem where you solve for the molarity of a substance after it has been diluted.

Suppose that you have 100 mL one hundred milliliters of a 3.0 M solution of HCl. You dilute the solution by adding enough water to make the solution volume 500 mL. What is the new molarity of the solution?

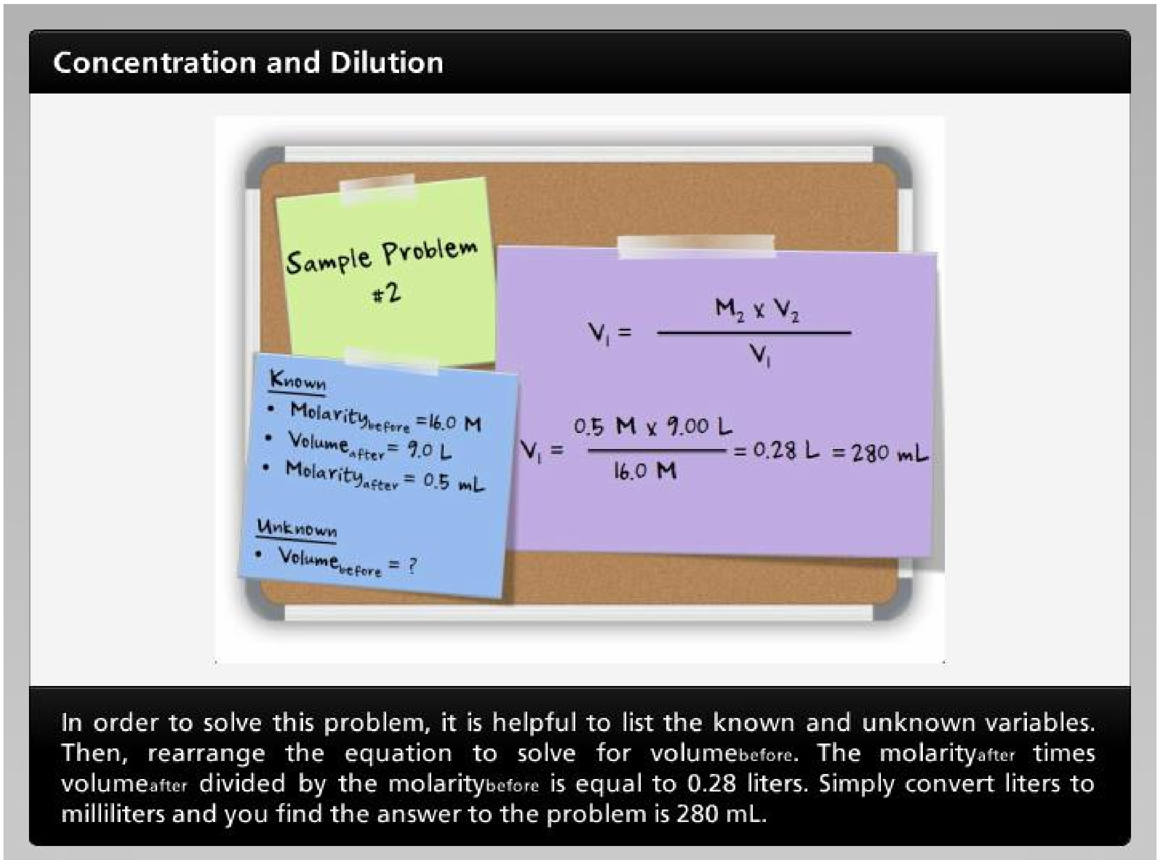


The new molarity is calculated by using the equation and solving for $\text{molarity}_{\text{after}}$. In order to solve this problem, it is helpful to list the known and unknown variables. Then, rearrange the equation to solve for $\text{molarity}_{\text{after}}$. The $\text{molarity}_{\text{before}}$ times $\text{volume}_{\text{before}}$ divided by the $\text{volume}_{\text{after}}$ is equal to 0.6 moles of HCl.



Now, try a problem that will allow you to decide how much of a concentrated solution is required to produce a quantity of a lesser concentration. Highly concentrated solutions are sometimes referred to as stock solutions.

Nitric acid is a strong acid. It is sold as a 16 M stock solution. How much of the stock solution of nitric acid in milliliters needs to be used to make 9.00 L of a 0.50 M solution?



In order to solve this problem, it is helpful to list the known and unknown variables. Then, rearrange the equation to solve for $volume_{before}$. The $molarity_{after}$ times $volume_{after}$ divided by the $molarity_{before}$ is equal to 0.28 liters. Simply convert liters to milliliters and you find the answer to the problem is 280 mL.