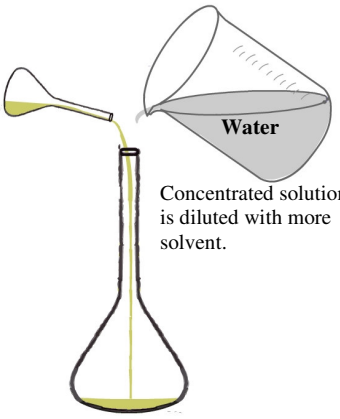
Dilution
Chem Worksheet 15-5

Name _____

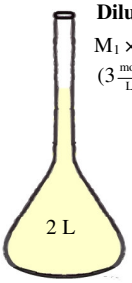
Conc. Solution

$M_1 \times V_1 = \text{mol}$

$(12 \frac{\text{mol}}{\text{L}})(0.5\ \text{L}) = 6\ \text{mol}$



Concentrated solution is diluted with more solvent.



Dilute Solution

$M_1 \times V_1 = \text{mol}$

$(3 \frac{\text{mol}}{\text{L}})(2\ \text{L}) = 6\ \text{mol}$

A solution can be made less concentrated in a process called **dilution**. This is accomplished by adding more solvent. This process decreases the molarity of the solution - the moles of solute in a dilute solution remain constant while the volume of solvent is increased.

USEFUL EQUATIONS

$M_1 \times V_1 = M_2 \times V_2$ molarity = $\frac{\text{mol solute}}{\text{L solution}}$

1 L = 1000 mL

Let's assume that you have 0.500 L of a hydrochloric acid solution with a concentration of 12 *M*. This sample contains 6 moles of HCl. When this solution is placed in a larger flask and water is added until the volume reaches 2.00 L a more dilute solution is created. There are still 6 moles of HCl in the solution, but the new volume is 2.00 L. So, the concentration is now 6 moles/2.00 liters, or 3 *M*. A simple formula used when diluting solutions is $\text{molarity}_1 \times \text{volume}_1 = \text{molarity}_2 \times \text{volume}_2$.

example

Calculate the molarity of the solution that forms when 10 mL of a 6.0 *M* solution is diluted to a volume of 250 mL.

- determine variables: $M_1 = 6.0\ M$ $V_1 = 10.0$ mL $M_2 = ?$ $V_2 = 250$ mL

- substitute and solve: $M_1 \times V_1 = M_2 \times V_2$

$$(6.0\ M)(10.0\ \text{mL}) = M_2(250\ \text{mL})$$

$$\frac{(6.0\ M)(10.0\ \text{mL})}{250\ \text{mL}} = \frac{M_2(250\ \text{mL})}{250\ \text{mL}}$$

$$M_2 = 0.24\ M$$

Solve the following dilution problems.

1. A stock solution of sodium sulfate, Na_2SO_4 has a concentration of 1.00 *M*. The volume of this solution is 50 mL. What volume of a 0.25 *M* solution could be made from the stock solution?
2. 2.00 mL of a 0.75 *M* solution of potassium permanganate, K_2MnO_4 solution is used to make a 500.00 mL solution. What is the concentration of the new solution?
3. A hydrochloric acid solution, HCl has a concentration of 12.1 *M*. A 41.2 mL sample is used to make a more dilute solution. If the new solution has a concentration of 0.5 *M*, determine the volume of the solution.
4. A 0.50 *M* solution of sodium thiosulfate, $Na_2S_2O_3$ is used to create a more dilute solution. If 250 mL of the concentrated solution is diluted to a volume of 2.5 L, determine the concentration of the new solution.
5. A stock solution of potassium nitrate, KNO_3 has a concentration of 0.25 *M*. What volume of dilute potassium nitrate (0.10 *M*) can be formed with 80.0 mL of the concentrated solution?
6. What volume of concentrated nitric acid, HNO_3 (15.8 *M*) should be added to water to form 500.0 mL of a 3.0 *M* nitric acid solution?
7. A sample of 7.0 mL of concentrated sulfuric acid, H_2SO_4 is used to make 250. mL of a 0.50 *M* sulfuric acid solution. What was the initial concentration of the sulfuric acid?
8. An instructor needs to make 400 mL of a silver nitrate solution that has a concentration of 0.01 *M*. How many milliliters of the 0.5 *M* solution should be used?