Calculating percent by mass/volume
Chem Worksheet 15-2

Name _____

solute

SALT
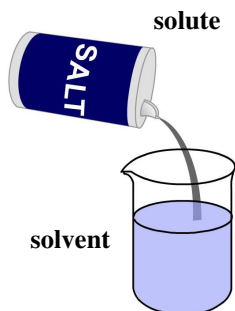
solvent

Solutions are comprised of two parts – the solute and the solvent. The **solute** is the substance that gets dissolved, and is present in a smaller amount. The **solvent** is the substance that does the dissolving and is present in a greater amount. A solution that has a lot of solute per solvent is described as **concentrated**, while a solution with a small amount of solute is called **dilute**.

The concentration of a solution is commonly given a number value by dividing the moles of the solute by the liters of the solution. This measurement is known as the **molarity** of a solution and it has units of mol/L or *M*. To find the molarity of a solution, you must know the moles of solute and the liters of solution. Recall the grams can be converted to moles using the molar mass. Also remember that the volumes in milliliters can be converted to liters (see table to the right).

USEFUL EQUATIONS

$$\text{molarity} = \frac{\text{mol solute}}{\text{L solution}} \qquad 1\text{ L} = 1000\text{ mL}$$

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example

What is the molarity of a solution that contains 7.8 g of $Al(OH)_3$ dissolved in 250.0 mL of water.

- convert grams of solute to moles:

$$\frac{7.8\text{ g } Al(OH)_3}{1} \times \frac{1\text{ mol } Al(OH)_3}{78.0\text{ g } Al(OH)_3} = 0.10\text{ mol } Al(OH)_3$$

- convert milliliters of solution to liters:

$$\frac{250.0\text{ mL}}{1} \times \frac{1\text{ L}}{1000\text{ mL}} = 0.250\text{ L}$$

- divide the moles solute by the liters solution:

$$\frac{0.10\text{ mol } Al(OH)_3}{0.250\text{ L solution}} = 0.40\,M\ Al(OH)_3$$

Answer the following questions. Show all work and report answers with units.

1. A solution has a volume of 2500 mL. How many liters is this?

2. Convert 50 g of calcium carbonate, $CaCO_3$, into moles.

3. A solution contains 0.42 moles of solute in 0.75 L. Calculate the molarity of the solution.

4. What is the molarity of a solution that contains 15.0 g of NaOH per 500.0 mL of solution?

5. A 250.0 mL solution contains 4.6 g of copper (II) chloride, $CuCl_2$. Find the molarity of this solution.

6. How many moles of hydrochloric acid, HCl, are present in 0.085 L of a 3.0 *M* solution?

7. A 37.5 mL solution contains 0.181 g of potassium chromate, K_2CrO_4. What is the molarity?

8. What is the molarity of a solution that contains 0.85 g of ammonium nitrate, NH_4NO_3, dissolved in a solution with volume 100.0 mL?

9. Calculate the mass of lead (II) nitrate, $Pb(NO_3)_2$, necessary to make 50.0 mL of a 0.100 *M* solution.

10. What volume of a 0.35 *M* solution of sodium chloride could be formed with 25 g of NaCl?