Calculating Concentration  
Chapter 18

**Molarity** - Molarity is _______ of _______ divided by _______ of _________.

\[
Molarity (M) = \frac{\text{Moles of Solute}}{\text{Volume of Solution (L)}}
\]

**Example #1**

What is the molarity of a solution that is 0.90g NaCl diluted to 100 mL of solution?

**Example #2**

How many grams of solute are in 1.5L of 0.20 M Na\(_2\)SO\(_4\)?

**Making a molar solution**

(a) A weighed amount of a substance (the solute) is put into the volumetric flask, and a small quantity of water is added.

(b) The solid is dissolved in the water by gently swirling the flask (with the stopper in place).

(c) More water is added, until the level of the solution just reaches the mark etched on the neck of the flask

Describe how to make the solution in example #2

Find a 1.5 L ________________ flask. Add _______g of Na\(_2\)SO\(_4\) to the flask and add some ____________ water. Shake to ________________ the solid and then add more distilled water until you have a total volume of ________________ L as evident by the etched ____________ in the neck of the flask.
**Making Dilutions using molarity**

$$M_1V_1 = M_2V_2$$

You can only make a more ___________ solution from a more ___________ solution.

If your kool-aid is too strong, you can add more water to dilute it.

If your kool-aid is too weak, you cannot conveniently subtract water to make it better.

**Example #3**

How do you make 100. mL of a 0.40 M MgSO$_4$ solution from a 2.0 M MgSO$_4$ solution?

**Example #4**

200. mL of a 0.2 M LiNO$_3$ solution and 100. mL of water are added together. What is the molarity of the new solution?

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**Mass Percent**

Percent by mass is mass of solute in grams divided by volume of solution in milliliters.

$$\text{Mass\%} = \frac{\text{Mass of Solute (g)}}{\text{Volume of Solution (mL)}} \times 100$$

**Example #5**

How would you make a 25% solution of sodium chloride with 6 g of salt?

**Example #6**

What is the percent by mass of 250. mL of solution that contains 10.5 g of potassium iodide?
Volume Percent

Percent by volume is volume of solute in milliliters divided by volume of solution in milliliters.

\[
Volume\% = \frac{Volume\ of\ Solute\ (mL)}{Volume\ of\ Solution\ (mL)} \times 100
\]

Example #7

What is the percent by volume of 100 mL of an alcohol solution that is 20 mL alcohol?

Example #8

How many milliliters of benzene are in a 1.0L of a 6.5% benzene solution?

Molality

Molality is moles of solute divided by kilograms of solvent

\[
Molality\ (m) = \frac{Moles\ of\ Solute}{Mass\ of\ Solvent\ (kg)}
\]

Example #9

What is the molality of a solution that is 0.4 moles of KMnO₄ and 800 g of water?