

## Molarity Tutorial

$$\text{Molarity} = \frac{\text{moles}}{\text{Liters}}$$

Examples:

1. What is the molarity of 350.0 mL solution that contains 50.00 grams of sodium hydroxide?

To solve:

Turn 350.0 mL to L:

$$(x) \text{ L} = 350.0 \text{ mL} \quad \left| \quad \begin{array}{l} 1 \text{ L} \\ 1000 \text{ mL} \end{array} \right. = 0.3500 \text{ L}$$

Turn 50.00 g of sodium hydroxide into moles:

$$(x) \text{ mol} = 50.00 \text{ g NaOH} \quad \left| \quad \begin{array}{l} 1 \text{ mol} \\ 40.00 \text{ g} \end{array} \right. = 1.250 \text{ mol}$$

Now calculate molarity:

$$M = \frac{\text{mol}}{\text{L}} = \frac{1.250 \text{ mol}}{0.3500 \text{ L}} = 3.571 \text{ M}$$

2. How many grams of sodium hydroxide are needed to make 50.00 mL of a 0.40 M solution?

(Remember that  $0.40 \text{ M} = \frac{0.40 \text{ mol}}{1 \text{ L}}$ ; which has 2 SF)

To solve:

One problem method:

$$(x) \text{ g} = 50.00 \text{ mL} \quad \left| \quad \begin{array}{l} 1 \text{ L} \\ 1000 \text{ mL} \end{array} \right. \quad \left| \quad \begin{array}{l} 0.40 \text{ mol} \\ 1 \text{ L} \end{array} \right. \quad \left| \quad \begin{array}{l} 40.00 \text{ g} \\ 1 \text{ mol} \end{array} \right. = 0.80 \text{ g}$$

Another method:

Solve for moles:

$$M = \frac{\text{mol}}{\text{L}} \quad 0.40 \text{ M} = \frac{X \text{ mol}}{0.0500 \text{ L}} \quad X \text{ mol} = 0.020 \text{ mol}$$

Now solve for g:

$$(x) \text{ g} = 0.020 \text{ mol} \quad \left| \quad \begin{array}{l} 40.00 \text{ g} \\ 1 \text{ mol} \end{array} \right. = 0.80 \text{ g}$$

$$M_1V_1 = M_2V_2$$

You can add water to a solution to create a more dilute solution.

Examples:

1. Water is added to 100.0 mL of 5.00 M NaCl. If the new volume is 250.0 mL, what is the dilute concentration?

*To solve:*

$$M_1 = 5.00 \text{ M}$$

$$V_1 = 100.0 \text{ mL}$$

$$M_2 = ?$$

$$V_2 = 250.0 \text{ mL}$$

$$M_1V_1 = M_2V_2$$

$$(5.00 \text{ M})(100.0 \text{ mL}) = (M_2)(250.0 \text{ mL})$$

$$M_2 = 2.00 \text{ M}$$

2. How can you make 500.0 mL of a 1.00 M HCl solution from 12.1 M concentrated HCl?

*To solve:*

$$M_1 = 12.1 \text{ M}$$

$$V_1 = ?$$

$$M_2 = 1.00 \text{ M}$$

$$V_2 = 500.0 \text{ mL}$$

$$M_1V_1 = M_2V_2$$

$$(12.1 \text{ M})(V_1) = (1.00 \text{ M})(500.0 \text{ mL})$$

$$V_1 = 41.3 \text{ mL}$$

Use a pipet to transfer 41.3 mL of 12.1M HCl to a 500.0 mL volumetric flask (that already contains some distilled water for safety purposes). Add more distilled water until the total volume reaches 500.0 mL (on the line).



