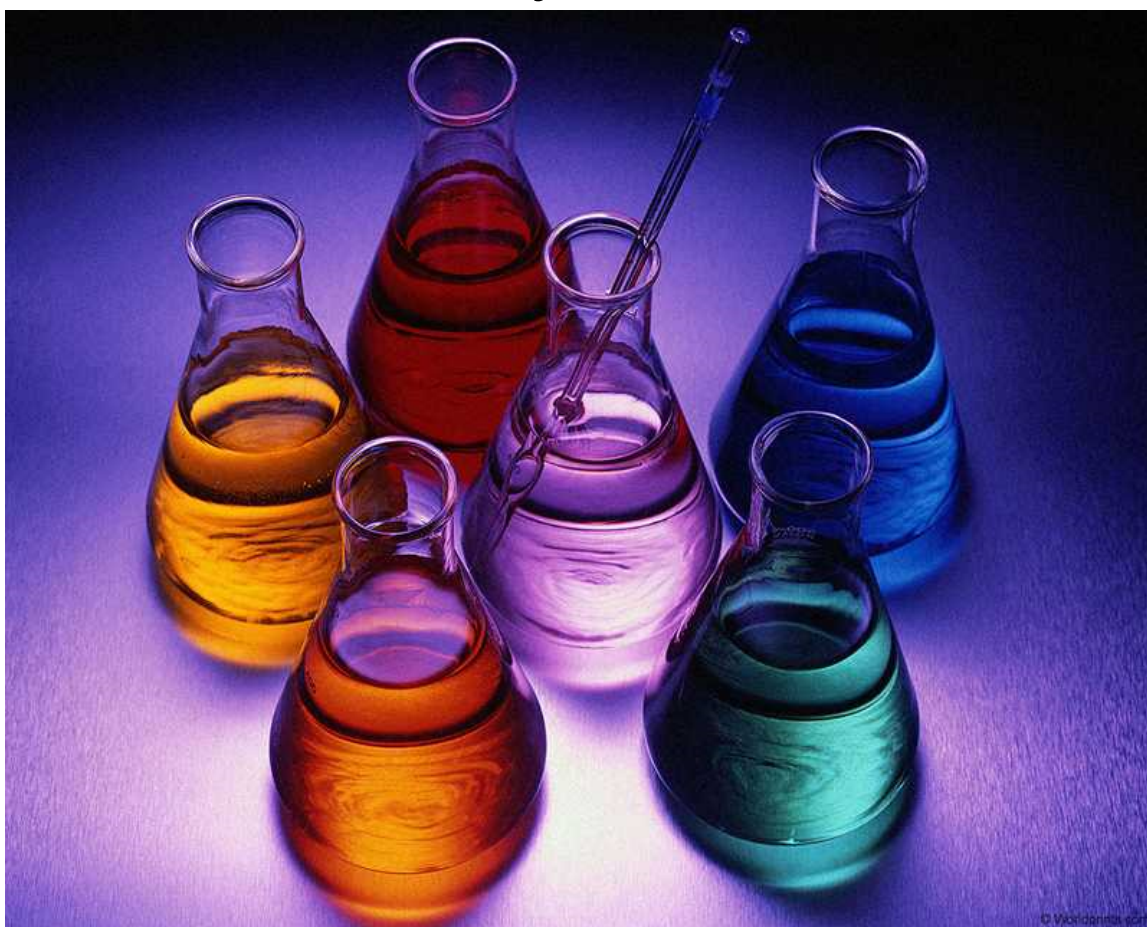


## Solutions- Molarity



## Concentration of Solute

The amount of solute in a solution is given by its **concentration**.

$$\text{Molarity (M)} = \frac{\text{moles solute}}{\text{liters of solution}}$$

4 moles of NaCl are dissolved in 5 L.  
What is the molarity?

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You have 0.8L of a 0.5M KCl solution.  
How many moles of KCl does this solution contain?

How many grams of KCl were  
used to make this solution?

4 moles of NaCl are dissolved in 5 L.  
What is the molarity?

$$M = \frac{\text{mol}}{\text{L}}$$

$$\frac{4 \text{ mol}}{5 \text{ L}} = 0.8 \text{ Molar solution of NaCl}$$

0.8 M NaCl solution

You have 800mL of a 0.5M KCl solution.  
How many moles of HCl does this solution contain?

$$M = \frac{\text{mol}}{\text{L}}$$

$$0.5M = \frac{x \text{ mol KCl}}{0.8 \text{ L}}$$

$$\frac{800 \text{ mL}}{1000 \text{ mL}} \left| \frac{1 \text{ L}}{1000 \text{ mL}} \right. = 0.800 \text{ L}$$

$$x = 0.4 \text{ mol KCl}$$

How many grams of KCl were used to make this solution?

$$\begin{array}{l} \text{K } 39 \\ \text{Cl } 35.5 \\ \hline 74.5 \text{ g/mol} \end{array} \quad \frac{0.4 \text{ mol KCl}}{1 \text{ mol KCl}} \left| \frac{74.5 \text{ g KCl}}{1 \text{ mol KCl}} \right. = 29.8 \text{ g KCl}$$

**PROBLEM:** Dissolve 5.00 g of  $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$  in enough water to make 250 mL of solution. Calculate the Molarity.

**Step 1:** Calculate moles of  $\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$

$$\left. \begin{array}{l} \text{Ni } 1 \times 59 = 59 \\ \text{Cl } 2 \times 35.5 = 71 \\ \text{H } 12 \times 1 = 12 \\ \text{O } 6 \times 16 = 96 \end{array} \right\} 238 \text{ g/mol}$$

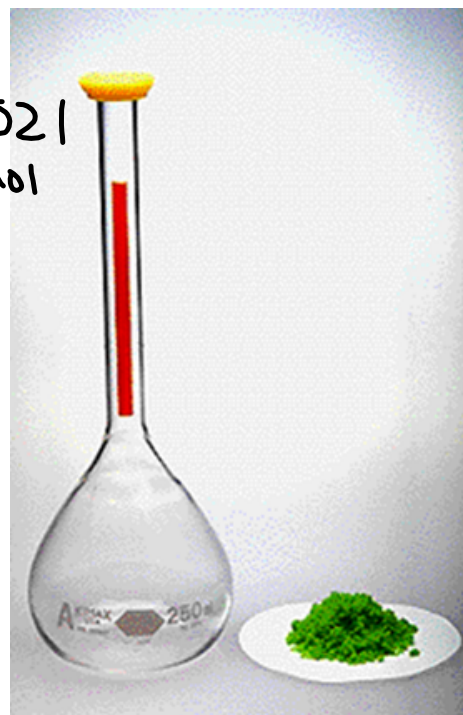
$$\frac{5 \text{ g } \text{NiCl}_2 \cdot 6\text{H}_2\text{O}}{238 \text{ g/mol}} = 0.021 \text{ mol}$$

$$\frac{250 \text{ mL}}{1000 \text{ mL}} = 0.250 \text{ L}$$

**Step 2:** Calculate Molarity

$$M = \frac{0.021 \text{ mol}}{0.250 \text{ L}} = 0.084 \text{ M}$$

$\text{NiCl}_2 \cdot 6\text{H}_2\text{O}$   
solution



$$[\text{NiCl}_2 \cdot 6\text{H}_2\text{O}] = 0.0841 \text{ M}$$

**What mass of oxalic acid,  $\text{H}_2\text{C}_2\text{O}_4$ , is required to make 250. mL of a 0.0500 M solution?**

What mass of oxalic acid,  $\text{H}_2\text{C}_2\text{O}_4$ , is required to make 250. mL of a 0.0500 M solution?

Change mL to L.

$$\frac{250 \text{ mL}}{1000 \text{ mL}} \times \frac{1 \text{ L}}{1} = 0.250 \text{ L}$$

Calculate.

$$M = \frac{\text{mol}}{\text{L}}$$

$$0.05\text{M} = \frac{x \text{ mol}}{0.250 \text{ L}}$$

$$x = 0.0125 \text{ mole } \text{H}_2\text{C}_2\text{O}_4$$

Convert moles to grams.

$$\text{H } 2 \times 1 = 2$$

$$\text{C } 2 \times 12 = 24$$

$$\text{O } 4 \times 16 = \underline{64}$$

$$90 \text{ g/mol}$$

$$\frac{0.0125 \text{ mol} \mid 90.00 \text{ g}}{1 \text{ mol}} = \mathbf{1.13 \text{ g } \text{H}_2\text{C}_2\text{O}_4}$$

How many grams of NaOH are required to prepare 400. mL of 3.0 M NaOH solution?



How many grams of NaOH are required to prepare 400. mL of 3.0 M NaOH solution?

$$M = \frac{\text{mol}}{\text{L}}$$

$$\frac{400 \text{ mL}}{1000 \text{ mL}} \left| \frac{1 \text{ L}}{1000 \text{ mL}} \right. = 0.400 \text{ L}$$

$$3.0 \text{ M} = \frac{x \text{ mol}}{0.400 \text{ L}}$$

$$x = 1.2 \text{ mol NaOH}$$

Na 23

O 16

H 1

40 g/mol NaOH

$$\begin{array}{l} \downarrow \\ \frac{1.2 \text{ mol NaOH}}{1 \text{ mol}} \left| \frac{40 \text{ g}}{1 \text{ mol}} \right. = 48 \text{ g NaOH} \end{array}$$

1. 3 moles of NaCl are dissolved in 8 L.  
What is the molarity?

2. Calculate the molarity of a KCl solution if 37.3 g of KCl are dissolved to give a final solution volume of 500 mL.  
Show your work.

## Attachments

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soluble-salts\_en-1.jnlp