



Concentration

Molarity(M): number of moles of solute per liter of solution

$$M = \frac{\# \text{ moles of solute}}{\text{volume (liter)}} = \frac{n}{V}$$

M.wt. NaOH = 23 + 16 + 1 = 40g/mol

To prepare 1M solution of NaOH

Take 40 grams of NaOH and add water to make exactly 1 liter of solution.

Notice that the definition is based on the total volume of the solution.



Example

How many grams of NaOH should be used to prepare 250mL of 0.300 M NaOH?

$$M = 0.300 = \frac{n}{0.250} \Rightarrow n = 0.250 \times 0.300 = 0.0750 \text{ mol}$$

$$0.0750 \text{ mol} \times 40.0 \text{ g/mol} = 3.00 \text{ g}$$



Example

How many moles of AgNO_3 are there in 25.0 mL solution of 0.600M AgNO_3 ?

$$M = \frac{n}{V}$$

$$0.600 = \frac{n}{0.025} \Rightarrow n = 0.025 \times 0.600 = 0.0150 \text{ mol}$$



dilution of solutions

$$M_1 \times V_1 = M_2 \times V_2$$

Example:

What volume of 2.0M KOH should be used to prepare 4.0L of 1.5M KOH?

$$M_1 = 2.0$$

$$M_2 = 1.5$$

$$V_1 = ?$$

$$V_2 = 4.0L$$

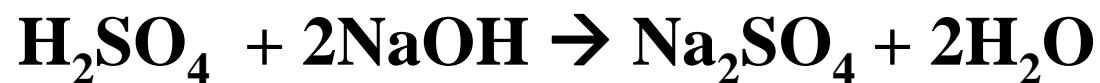
$$2.0 \times V_1 = 1.5 \times 4.0$$

$$V_1 = \frac{1.5 \times 4.0}{2.0} = 3.0L$$



Example

What volume (mL) of 0.750M NaOH is needed to react with 50.0mL of 0.150M H₂SO₄?



Moles of H₂SO₄ in 50.0mL:

$$0.050\text{L} \times 0.150\text{M} = 0.0075\text{mol}$$

from the equation: 2mol NaOH = 1mol H₂SO₄

from the problem: x mol NaOH = 0.0075mol



$$x = 0.0150 \text{ mol NaOH}$$

$$M = \frac{n}{V} \Rightarrow 0.750 = \frac{0.0150 \text{ mol}}{V} \Rightarrow$$

$$V = \frac{0.0150}{0.750} = 0.020 \text{ L} = 20.0 \text{ mL}$$