# Solutions

**Mixture**- Contains 2 or more substances in varying composition

$NaHCO_3(s) + Na_2CO_3(s)$

**Solution**- Homogeneous mixture

Components are mingled uniformly

Sugar dissolved in water

**Solute**- Present in a smaller quantity

**Solvent**- Present in a larger quantity

Solute(s) + solvent = solution

# Solution Composition

pph: parts per hundred or mass percentage (%)

$$\frac{\text{mass solute(s)}}{\text{mass solution}}$$

Molarity (M)

$$\frac{\dfrac{\text{mass solute}}{\text{molar mass}}}{\text{volume solution}}$$

# Dilutions

Amount of solute after dilution = Amount of solute before dilution

0.01 mol solute / 100 mL $\xrightarrow{\text{Add } H_2O}$ 0.01 mol solute / 200 mL

$M_1V_1 = M_2V_2$

$\frac{0.01}{100 \times \frac{1}{1000}} = 0.1\ M$ $\qquad$ $\frac{0.01}{200 \times \frac{1}{1000}} = 0.05\ M$

A solution is prepared by dissolving 3.47 g of $Al_2(SO_4)_3$ (s) (342.15 g/mol) in enough water to make 250.0 mL of solution. Determine the molar concentration (M) of $Al_2(SO_4)_3$.

$$\frac{3.47\ g \cdot \frac{1\ mol}{342.15\ g}}{0.25\ L} = 0.0406\ M$$

A 50.00 mL portion of the above solution was diluted to a final volume of 125.0 mL using water. Determine the new concentration of the $Al_2(SO_4)_3$ solution.

$$0.0406\ M \cdot 0.05\ L = M_2 \cdot 0.125\ L$$

$$M_2 = \frac{0.0406(0.05)}{0.125} = 0.0162\ M$$

Calculate the molar concentration of $SO_4^{2-}$ ($[SO_4^{2-}]$) in this solution.

$$0.0162\ M \cdot \frac{3\ SO_4}{1\ Al_2(SO_4)_3} = 0.0486\ M\ SO_4^{2-}$$