

Concentration Units: Molarity

$$M = \frac{\text{moles solute}}{L \text{ solution}}$$

1. What is the molarity of a solution prepared with 2.65 g of silver nitrate (AgNO_3) and then diluted with water to 500.00 mL?

$$M_m \text{ AgNO}_3 = 169.87 \text{ g/mol}$$

$$2.65 \text{ g AgNO}_3 \times \frac{1 \text{ mol}}{169.87 \text{ g}} = 0.0156 \text{ mol AgNO}_3$$

$$500.00 \text{ mL} = 0.50000 \text{ L}$$

$$M = \frac{0.0156 \text{ mol AgNO}_3}{0.50000 \text{ L}} = \mathbf{0.0312 \text{ M}}$$

2. How many g of sodium hydroxide, NaOH , are required to prepare 50.00 mL of solution that is 0.464 M NaOH ?

First, find the moles of NaOH and then convert to grams

$$M = \frac{\text{moles solute}}{L \text{ solution}} \quad \text{and}$$

$$\text{moles} = M \times V(L) = 0.464 \frac{\text{mol}}{L} \times 0.05000 \text{ L} = 0.0232 \text{ mol}$$

Convert moles to grams. $M_m \text{ NaOH} = 39.997 \text{ g/mol}$

$$0.0232 \text{ mol} \times \frac{39.997 \text{ g}}{1 \text{ mol}} = \mathbf{0.928 \text{ g NaOH}}$$

3. How many grams of H_2SO_4 are present in 1.25 liters of a 0.855 M solution?

$$M_m \text{ H}_2\text{SO}_4 = 98.079 \text{ g/mol}$$

$$0.855 \frac{\text{mol}}{L} \times 1.25 \text{ L} = 1.069 \text{ mol H}_2\text{SO}_4$$

$$1.069 \text{ mol} \times \frac{98.079 \text{ g}}{1 \text{ mol}} = \mathbf{105 \text{ g H}_2\text{SO}_4}$$

4. How many mL of 0.855 M K_2CrO_4 is required to prepare 25.00 mL of a solution that is 0.125 M K_2CrO_4 ?

$$M_1V_1 = M_2V_2 \quad M_1 = 0.855 \text{ M}, V_1 = ?, M_2 = 0.125 \text{ M}, \text{ and } V_2 = 25.00 \text{ mL}$$

Solve for V_1

$$V_1 = \frac{M_2V_2}{M_1} = \frac{0.125 \text{ M} \times 25.00 \text{ mL}}{0.855 \text{ M}} = \mathbf{3.65 \text{ mL}}$$

5. If 72.50 mL of 2.64 M HCl is added to a 250.00 mL volumetric flask and diluted to the mark, what is the concentration of the solution?

$$M_1V_1 = M_2V_2 \quad M_1 = 2.64 \text{ M}, V_1 = 72.50 \text{ mL}, M_2 = ?, \text{ and } V_2 = 250.00 \text{ mL}$$

Solve for M_2 .

$$M_2 = \frac{M_1V_1}{V_2} = \frac{2.64 \text{ M} \times 72.50 \text{ mL}}{250.00 \text{ mL}} = \mathbf{0.766 \text{ M}}$$