



Molarity Problems

FORMULAS:

$$\text{Molarity: } M = \frac{\text{moles of solute}}{\text{litres of solution}} \text{ (mol/L)}$$

$$\text{Dilution problems: } M_1V_1 = M_2V_2$$

$$\text{Molar mass: } n = \frac{m}{\text{MW}} \text{, where } n = \text{number of moles}$$

$$m = \text{mass}$$

$$\text{MW} = \text{molecular weight (g/mol)}$$

Example 1: Determine the molarity of 3.72 moles of NaBr in 575 mL of solution.

$$\text{Solution: } [\text{NaBr}] = \frac{3.72 \text{ mol}}{0.575 \text{ L}} = 6.47 \text{ mol/L}$$

Example 2: How many millilitres of concentrated H_2SO_4 (18.0 M) is required to prepare 250 mL of 6.00 M H_2SO_4 solution?

Solution: desired: $M_1 = 6.00 \text{ M}$; $V_1 = 250 \text{ mL}$

on hand: $M_2 = 18.0 \text{ M}$; $V_2 = ?$

$$V_2 = \frac{M_1V_1}{M_2} = \frac{(6.00 \text{ M})(250 \text{ mL})}{18.0 \text{ M}} = 83.3 \text{ mL } \text{H}_2\text{SO}_4$$

Example 3: 15.32 mL of 0.5250 M HCl is required to titrate 17.50 mL of a NaOH solution. Determine the concentration of the NaOH solution.

Solution: Because we have a titration, we need the formula equation for the reaction:



moles of acid: $0.5250 \text{ mol/L} \times (15.32 \times 10^{-3} \text{ L}) = 8.043 \times 10^{-3} \text{ mol HCl}$

$8.043 \times 10^{-3} \text{ mol HCl}$ reacts with $8.043 \times 10^{-3} \text{ mol NaOH}$

concentration (molarity): $\frac{8.043 \times 10^{-3} \text{ mol NaOH}}{1.750 \times 10^{-2} \text{ L NaOH}} = 0.4596 \text{ mol/L}$

EXERCISES

- Determine the molarity of a solution containing 2.58 mol NaCl in 455 mL of solution.
- Determine the number of moles of KOH present in 95.0 mL of 0.255 M solution.
- 12.5 g of Na_2CO_3 is dissolved in water to make 325 mL of solution. What is the concentration?
- What volume of 0.500 M BaCl_2 will contain 16.2 g BaCl_2 ?