



## 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  $\text{H}_2\text{SO}_4$  (18.0 M) is required to prepare 250 mL of 6.00 M  $\text{H}_2\text{SO}_4$  solution?

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

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

$$V_2 = \frac{M_1V_1}{M_2} = \frac{(6.00 \text{ M})(250 \text{ mL})}{18.0 \text{ M}} = 93.8 \text{ mL } \text{H}_2\text{SO}_4$$

**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  $8.043 \times 10^{-3} \text{ mol NaOH}$

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

### 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  $\text{Na}_2\text{CO}_3$  is dissolved in water to make 325 mL of solution. What is the concentration?
- What volume of 0.500 M  $\text{BaCl}_2$  will contain 16.2 g  $\text{BaCl}_2$ ?