Molarity Problems

FORMULAS

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

Dilution problems: $M_1V_1 = M_2V_2$

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

m = mass

MW = molecular weight (g/mol)

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

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

Example 2: How many millilitres of concentrated H_2SO_4 (16.0 M) is required to prepare 250 mL of 6.00 M H_2SO_4 solution?

Solution: desired: $M_1 = 6.00$ M; $V_1 = 250$ mL
on hand: $M_2 = 16.0$ M; $V_2 = ?$

$V_2 = \frac{M_1V_1}{M_2} = \frac{(6.00\ \text{M})(250\ \text{mL})}{16.0\ \text{M}} = 93.8\ \text{mL}\ H_2SO_4$

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:

$$HCl + NaOH \rightarrow NaCl + H_2O$$

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

8.043×10^{-3} mol HCl reacts with 8.043×10^{-3} 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

A. Determine the molarity of a solution containing 2.58 mol NaCl in 455 mL of solution.

B. Determine the number of moles of KOH present in 95.0 mL of 0.255 M solution.

C. 12.5 g of Na_2CO_3 is dissolved in water to make 325 mL of solution. What is the concentration?

D. What volume of 0.500 M $BaCl_2$ will contain 16.2 g $BaCl_2$?