

CHM 110
Sample molarity problems - set 2

Problem

3.47 g of NaBr solid is transferred to a volumetric flask. After filling to the mark with water, the total volume of the solution is 100.0 mL. Calculate the molar concentration of the solution.

Solution

Find the moles of NaBr used, then divide by the solution volume in liters.

Substance	Formula weight
NaBr	102.89 g/mol

$$3.47 \text{ g NaBr} \times \frac{\text{mol NaBr}}{102.89 \text{ g NaBr}} = 3.37 \times 10^{-2} \text{ mol NaBr}$$

$$\frac{3.373 \times 10^{-2} \text{ mol NaBr}}{0.1000 \text{ L}} = \mathbf{0.337 \text{ M NaBr}}$$

Problem

You use 47.3 mL of 0.337 M NaBr solution in a chemical reaction. How many moles of NaBr did you use? How many grams?

Solution

Use the definition of molarity. The formula weight below is only necessary to answer the question about mass - it's not required to use the formula weight to calculate moles from volume and molarity.

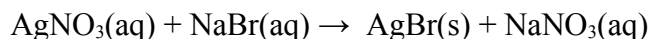
Substance	Formula weight
NaBr	102.89 g/mol

$$0.0473 \text{ L} \times \frac{0.337 \text{ mol NaBr}}{\text{L}} = \mathbf{0.0159 \text{ mol NaBr}}$$

$$0.0473 \text{ L} \times \frac{0.337 \text{ mol NaBr}}{\text{L}} \times \frac{102.89 \text{ g NaBr}}{\text{mol NaBr}} = \mathbf{1.64 \text{ g NaBr}}$$

Problem

How many milliliters of 0.337 M NaBr is needed to react with 1.00 g AgNO₃ in the reaction given below?

Solution

Convert grams of AgNO₃ to moles, use the chemical equation to relate moles of AgNO₃ to moles of NaBr, then convert moles of NaBr to volume using the molarity.

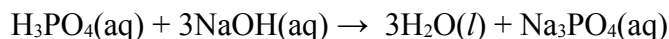
Substance	Formula weight
AgNO ₃	169.91 g/mol

$$1.00 \text{ g AgNO}_3 \times \frac{1 \text{ mol AgNO}_3}{169.91 \text{ g AgNO}_3} \times \frac{1 \text{ mol NaBr}}{1 \text{ mol AgNO}_3} \times \frac{1 \text{ L}}{0.337 \text{ mol NaBr}} = 1.75 \times 10^{-2} \text{ L}$$

The volume expressed in milliliters, is **17.5 mL**.

Problem

It takes 38.5 mL of 0.157 M NaOH to completely react with 10.0 mL of H₃PO₄ solution. Calculate the molar concentration of the H₃PO₄ solution. The reaction is given below.

Solution

Convert the volume of NaOH to moles using the molarity. Then, convert the moles of NaOH to moles of H₃PO₄ using the chemical equation. Finally, divide by the volume of the H₃PO₄ used to find its concentration. You don't need any formula weights at all to solve this problem!

$$0.0385 \text{ L NaOH} \times \frac{0.157 \text{ mol NaOH}}{1 \text{ L NaOH}} \times \frac{1 \text{ mol H}_3\text{PO}_4}{3 \text{ mol NaOH}} = 2.015 \times 10^{-3} \text{ mol H}_3\text{PO}_4$$

$$\frac{2.015 \times 10^{-3} \text{ mol H}_3\text{PO}_4}{0.0100 \text{ L}} = \mathbf{0.202 \text{ M H}_3\text{PO}_4}$$