CHM 110
Molarity Practice Set

Problem

A solution is prepared by dissolving 3.5137 g of Na_2CO_3 into enough water to make 250.0 mL of solution. What is the molar concentration of this solution?

Solution

Since molarity is defined as moles of solute per liter of solvent, calculate the number of moles of Na_2CO_3. Then divide by the volume of the solution.

Find the moles of Na_2CO_3.

$$3.5137\,\text{g Na}_2\text{CO}_3 \times \frac{\text{mol Na}_2\text{CO}_3}{105.99\,\text{g Na}_2\text{CO}_3} = 3.3151\times10^{-2}\,\text{mol Na}_2\text{CO}_3$$

Divide by the volume of the solution (in liters).

$$\frac{3.3151\times10^{-2}\,\text{mol Na}_2\text{CO}_3}{0.2500\,\text{L}} = \mathbf{0.1326\,M\ Na_2CO_3}$$

Problem

250.0 mL of a 0.0575 M solution of Na_3PO_4 is evaporated to dryness. How many grams of Na_3PO_4 solid can be recovered?

Solution

Molarity can be used to convert between solution volume and moles. So find the moles of Na_3PO_4 in the solution, then change to grams.

$$0.2500\,\text{L} \times \frac{0.0575\ \text{moles Na}_3\text{PO}_4}{\text{L}} \times \frac{163.94\,\text{g Na}_3\text{PO}_4}{\text{mol Na}_3\text{PO}_4} = \mathbf{2.36\,g\ Na_3PO_4}$$

Problem

Hydrochloric acid reacts with sodium carbonate by this reaction.

$$2HCl(aq) + Na_2CO_3(aq) \rightarrow H_2O(l) + CO_2(g) + 2NaCl(aq)$$

If it takes 34.2 mL of HCl solution to completely react with 2.00 g of Na_2CO_3. What is the molar concentration of the HCl solution?

Solution

This is a stoichiometry problem, much like the stoichiometry problems you have solved before. First, convert the grams of Na_2CO_3 to moles. Then, use the chemical equation to relate moles of Na_2CO_3 to moles of HCl. Finally, divide the moles of HCl by the volume of the HCl to find the molarity.

$$2.00\ \text{g Na}_2\text{CO}_3 \times \frac{\text{mol Na}_2\text{CO}_3}{105.99\ \text{g Na}_2\text{CO}_3} \times \frac{2\ \text{mol HCl}}{\text{mol Na}_2\text{CO}_3} = 3.773 \times 10^{-2}\ \text{mol HCl}$$

Remember to convert the volume to liters!

$$\frac{3.773 \times 10^{-2}\ \text{mol HCl}}{0.0342\ \text{L}} = \mathbf{1.10\ M\ HCl}$$