1. A solution that is labeled “3 M HCl” contains 3 mol of dissolved HCl per ______ of the solution.

2. A solution that is 1.0 M H₃PO₄ contains ______ mol of hydrogen ions and ______ mol of phosphate ion per liter.

3. If you were to prepare exactly 2.00 L of a 5 M NaCl solution, you would not need exactly 1.00 L of water. Explain.

   **Calculate the molarity of the following solutions:**

   4. 0.45 mol of NaCl dissolved in a solution with a total volume of 0.500 L

   5. 0.25 mol of NaCl dissolved in a solution with a total volume of 65.0 mL

   6. 8.0 g of CaCl₂ dissolved in a solution with a total volume of 8.5 L

   7. 1.5 g of Na₂SO₄ dissolved in a solution with a total volume of 225 mL

   8. 25.5 mg of sucrose (C₁₂H₂₂O₁₁) dissolved in enough water to make 12.0 mL of solution

   **Calculate the number of moles of the indicated solute in the following solutions:**

   9. 14.0 L of 0.250 M NaHCO₃ solution

   10. 63.0 L of 10.0 M HCl solution

   11. 50.0 mL of 1.4 M NaOH solution

   **Calculate the mass (in grams) of the indicated solute in each of the following solutions:**

   12. 3.00 L of 0.33 M NaCl solution

   13. 0.10 mL (approximately 2 drops) of 3.0 M HCl solution

   14. 175 mL of 2.05 M HNO₃ solution
Calculate the number of moles of the indicated ion present in each of the following solutions.

15. Na\(^+\) ion in 2.00 L of 0.51 M \(\text{Na}_3\text{PO}_4\) solution

16. Cl\(^-\) ion in 4.50 L of 0.10 M \(\text{CoCl}_2\) solution

17. NO\(_3^-\) ion in 600.0 mL of 0.25 M \(\text{Al(NO}_3)_3\) solution

Calculate the number of moles of each ion present in each of the following solutions.

18. 4.25 L of 0.150 M \(\text{Li}_3\text{PO}_4\) solution

19. 8.5 mL of 2.0 M \(\text{H}_2\text{SO}_4\) solution

20. Standard silver nitrate solutions are used in the titration analysis of samples containing chloride ion. How many grams of silver nitrate are needed to prepare 150.0 mL of standard 0.100 M \(\text{AgNO}_3\) solution?

21. Calcium carbonate can be obtained in a very pure state. Standard solutions of calcium ion are usually prepared by dissolving calcium carbonate in acid. What mass of \(\text{CaCO}_3\) should be taken to prepare 200.0 mL of 0.0600 M calcium ion solution?

22. On way to determine the amount of chloride ion in a water sample is to titrate the sample with standard \(\text{AgNO}_3\) solution to produce solid \(\text{AgCl}\). If a 25.0 mL water sample requires 17.2 mL of 0.121 M \(\text{AgNO}_3\) in such a titration, what is the concentration of Cl\(^-\) in the sample?

\[
\text{Ag}^{+}(\text{aq}) + \text{Cl}^{-}(\text{aq}) \rightarrow \text{AgCl} (\text{s})
\]

56. How many milliliters of 0.10 M \(\text{Na}_2\text{S}\) solution are required to precipitate all the nickel, as \(\text{NiS}\), from 15.0 mL of 0.10 M \(\text{NiCl}_2\) solution?

\[
\text{NiCl}_2 (\text{aq}) + \text{Na}_2\text{S} (\text{aq}) \rightarrow \text{NiS} (\text{s}) + 2 \text{NaCl} (\text{aq})
\]