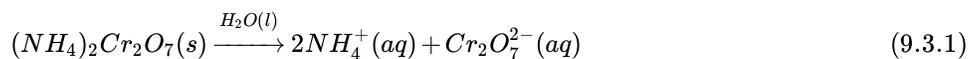


9.3: Solution Stoichiometry

Learning Objectives

- How to calculate the concentrations of ions when a salt is dissolved

In Example 9.3.2, the concentration of a solution containing 90.00 g of ammonium dichromate in a final volume of 250 mL were calculated to be 1.43 M. Let's consider in more detail exactly what that means. Ammonium dichromate is an ionic compound that contains two NH_4^+ ions and one $\text{Cr}_2\text{O}_7^{2-}$ ion per formula unit. Like other ionic compounds, it is a strong electrolyte that dissociates in aqueous solution to give hydrated NH_4^+ and $\text{Cr}_2\text{O}_7^{2-}$ ions:



Thus 1 mol of ammonium dichromate formula units dissolves in water to produce 1 mol of $\text{Cr}_2\text{O}_7^{2-}$ anions and 2 mol of NH_4^+ cations (see Figure 9.3.4).

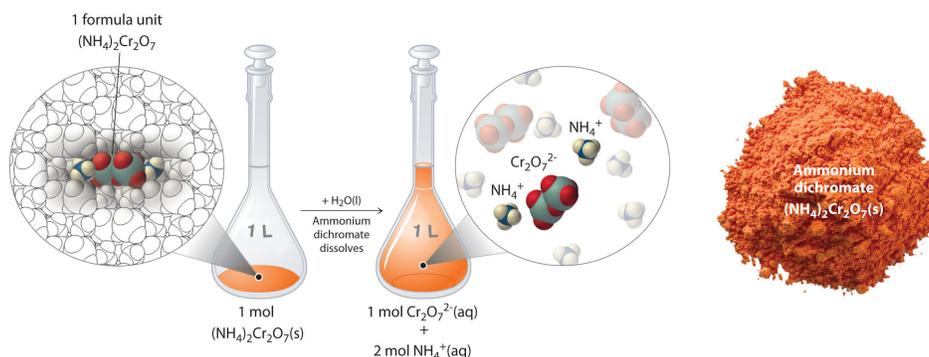


Figure 9.3.4: Dissolution of 1 mol of an Ionic Compound. In this case, dissolving 1 mol of $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ produces a solution that contains 1 mol of $\text{Cr}_2\text{O}_7^{2-}$ ions and 2 mol of NH_4^+ ions. (Water molecules are omitted from a molecular view of the solution for clarity.)

When carrying out a chemical reaction using a solution of a salt such as ammonium dichromate, it is important to know the concentration of each ion present in the solution. If a solution contains 1.43 M $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$, then the concentration of $\text{Cr}_2\text{O}_7^{2-}$ must also be 1.43 M because there is one $\text{Cr}_2\text{O}_7^{2-}$ ion per formula unit. However, there are two NH_4^+ ions per formula unit, so the concentration of NH_4^+ ions is $2 \times 1.43 \text{ M} = 2.86 \text{ M}$. Because each formula unit of $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ produces *three* ions when dissolved in water ($2\text{NH}_4^+ + 1\text{Cr}_2\text{O}_7^{2-}$), the *total* concentration of ions in the solution is $3 \times 1.43 \text{ M} = 4.29 \text{ M}$.



Concentration of Ions in Solution from a Soluble Salt: <https://youtu.be/qsekSJBLeMc>

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