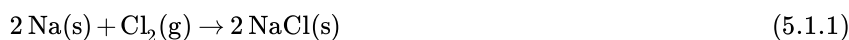


5.1: Sugar and Salt

Sodium chloride, also known as table salt, is an ionic compound with the chemical formula NaCl , representing a 1:1 ratio of sodium and chloride ions. It is commonly used as a condiment and food preservative. Salt can be created by adding two very reactive elements together: **sodium** (Na(s) metal) and **chlorine** ($\text{Cl}_2(\text{g})$ gas).



The element sodium (Figure 5.1.1a) is a very reactive metal; given the opportunity, it will react with the sweat on your hands and form sodium hydroxide, which is a very corrosive substance. The element chlorine (Figure 5.1.1b) is a pale yellow, corrosive gas that should not be inhaled due to its poisonous nature. Bring these two hazardous substances together, however, and they react to make the ionic compound sodium chloride (Figure 5.1.1c), known simply as salt.

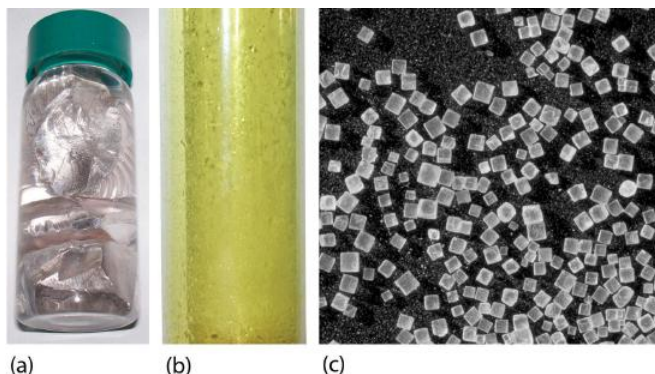


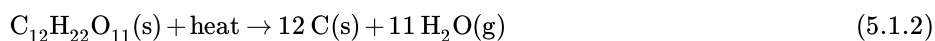
Figure 5.1.1: Sodium + Chlorine = Sodium Chloride (a) Sodium is a very reactive metal. (b) Chlorine is a pale yellow, noxious gas. (c) Together, sodium and chlorine make sodium chloride—salt—which is necessary for our survival. Source: Photo on the left courtesy of [reenhorn1](#) and photo in the center courtesy of [Benjah-bmm27](#). Photo on the right © Thinkstock.

Salt is necessary for life. Na^+ ions are one of the main ions in the human body and are necessary to regulate the fluid balance in the body. Cl^- ions are necessary for proper nerve function and respiration. Both of these ions are supplied by salt. The taste of salt is one of the fundamental tastes; salt is probably the most ancient flavoring known, and one of the few rocks we eat. Clearly when the elemental sodium and chlorine combine (Equation 5.1.1), the resulting salt product has radically different properties (both physical and chemical). This reaction is spectacular to observe (Video 5.1.1).



Video 5.1.1: Making Table Salt using Sodium Metal and Chlorine gas

Another compound is sugar, which is the generic name for sweet, soluble carbohydrates, many of which are used in food. Sugar has the chemical formula $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ and is constructed from different elements than salt: **carbon**, **hydrogen** and **oxygen**. While sugar qualitatively resembles table salt (often confused in the kitchen), the two have distinctly different physical and chemical properties. There are various types of sugar derived from different sources. While sugar is made with carbon, hydrogen, and oxygen, it is considerably harder to synthesize from its constituent elements than table salt is (Equation 5.1.1). However, the thermal decomposition is considerably easier and can be represented as a dehydration of sucrose to pure carbon and water vapor in Equation 5.1.2, and demonstrated in Video 5.1.2.



Video 5.1.2: *A science experiment in the kitchen shows what happens to sugar molecules when they are heated. The experiment did not disappoint!*

As with salt, sugar has radically different properties (both physical and chemical) than its constituent elements. This difference in properties, of constituent elements and compounds, is a central feature of chemical reactions.

Contributions & Attributions

- Wikipedia

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