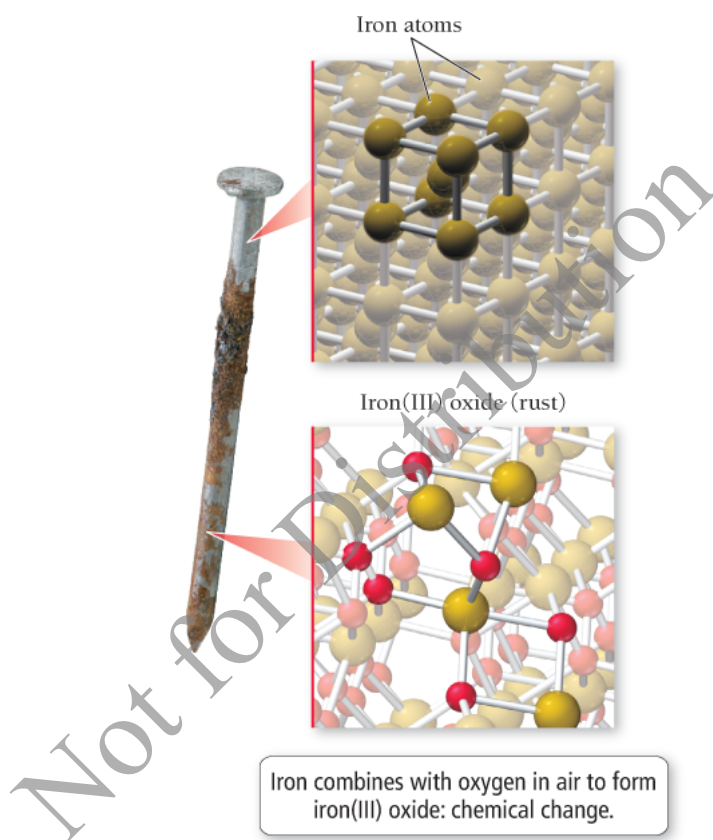


7.2: Chemical and Physical Change

The process by which a fossil fuel such as gasoline burns in the presence of oxygen is a *chemical change*. In a **chemical change**, atoms rearrange and the original substances (in this case gasoline) transform into different substances (in this case water and carbon dioxide). Other chemical changes include the rusting of iron (Figure 7.4), the burning of sugar in a hot pan, and the transformation of oxygen and carbon dioxide into glucose that occurs within plants during photosynthesis.

Figure 7.4 Rusting, a Chemical Change

When iron rusts, the iron atoms exchange electrons with oxygen atoms and combine with them to form a different chemical substance, the compound iron(III) oxide. Rusting is therefore a chemical change.

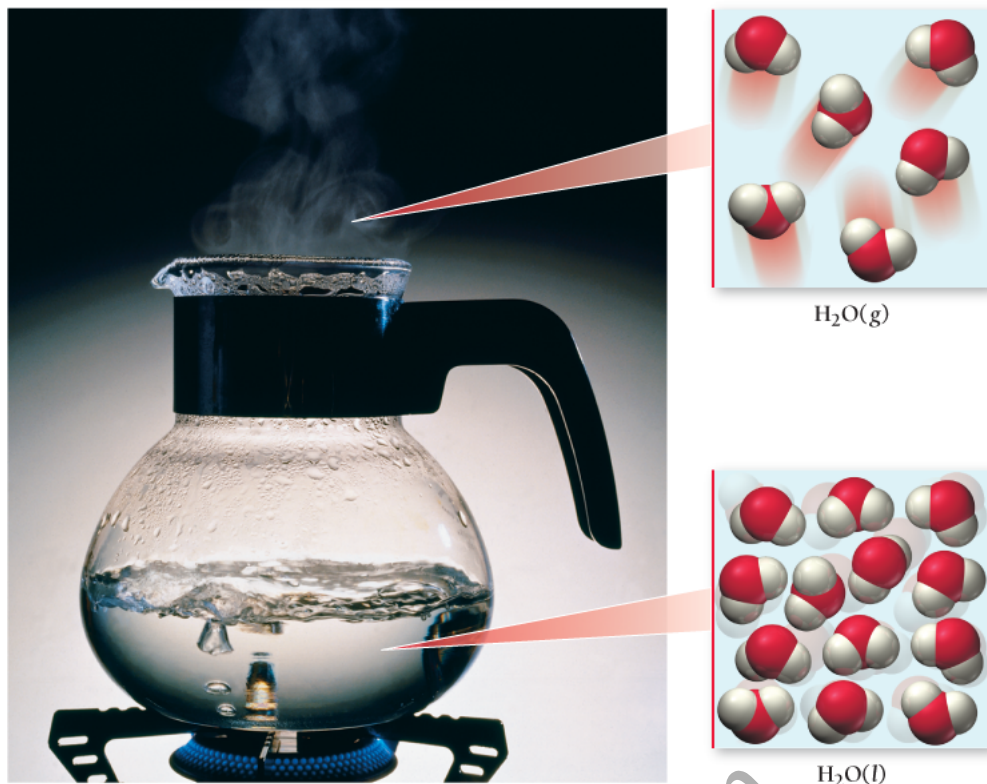


Matter can also undergo **physical changes**, which—in contrast to chemical changes—do not change its composition. The atoms or molecules that compose a substance *do not change* their identity during a physical change. For example, when water boils, it changes from the liquid state to the gas state, but the molecules composing the water remain intact (Figure 7.5).

Figure 7.5 Boiling, a Physical Change

When water boils, it turns into a gas but does not alter its chemical identity—the water molecules are the same in both the liquid and gaseous states. Boiling is thus a physical change, and the boiling point of water is a physical property.

Water molecules change from liquid to gaseous state: physical change.



A physical change results in a different form of the same substance, while a chemical change results in a completely different substance.

Chemical and physical changes are manifestations of chemical and physical properties. A **chemical property** is a property that a substance displays only by changing its composition via a chemical change, while a **physical property** is a property that a substance displays without changing its composition. The flammability of gasoline is a chemical property—gasoline changes its composition when it burns, turning into completely new substances (primarily carbon dioxide and water as we have already seen). The smell of gasoline, by contrast, is a physical property—gasoline does not change its composition when it exhibits its odor. Chemical properties include corrosiveness, flammability, acidity, toxicity, and other such characteristics. Physical properties include odor, taste, color, appearance, melting point, boiling point, and density.

The differences between chemical and physical changes are not always apparent. Only chemical examination can confirm whether any particular change is chemical or physical. In many cases, however, we can identify chemical and physical changes based on what we know about the changes. Chemical changes are often evidenced by temperature or color changes. Changes in the state of matter, such as melting or boiling, or changes in the physical condition of matter, such as those that result from cutting or crushing, are typically physical changes.

Conceptual Connection 7.1 Chemical Change

Conceptual Connection 7.2 Physical Change

Interactive Interact

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