Pearson

Chapter 3
Periodic Properties of the Elements

The majority of the material that composes most aircraft is aluminum.

> "It is the function of science to discover the existence of a general reign of order in nature and to find the causes governing this order."
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> *—Dmitri Mendeleev (1834–1907)*

Learning Outcomes

GREAT ADVANCES IN SCIENCE occur not only when a scientist sees something new, but also when a

scientist sees something everyone else has seen in a new way. That is what happened in 1869 when Dmitri Mendeleev, a Russian chemistry professor, saw a pattern in the properties of elements. Mendeleev's insight led to the development of the periodic table. Recall from Chapter 1 that theories explain the underlying reasons for observations. If we think of Mendeleev's periodic table as a compact way to summarize a large number of observations, then quantum mechanics is the theory that explains the underlying reasons. Quantum mechanics explains how electrons are arranged in an element's atoms, which in turn determines the element's properties. Because the periodic table is organized according to those properties, quantum mechanics elegantly accounts for Mendeleev's periodic table. In this chapter, we see a continuation of this book's theme—the properties of matter (in this case, the elements in the periodic table) are explained by the properties of the particles that compose them (in this case, atoms and their electrons).