Pearson

Chapter 2
The Quantum-Mechanical Model of the Atom

The thought experiment known as Schrödinger's cat is intended to show that the strangeness of the quantum world does not transfer to the macroscopic world.

> "I should be sorry I ever got involved with quantum theory."
>
> —*Erwin Schrödinger (1887–1961)*

Learning Outcomes

2.1 Schrödinger's Cat

2.2 The Nature of Light

2.3 Atomic Spectroscopy and the Bohr Model

2.4 The Wave Nature of Matter: The de Broglie Wavelength, the Uncertainty Principle, and Indeterminacy

2.5 Quantum Mechanics and the Atom

2.6 The Shapes of Atomic Orbitals

Key Learning Outcomes

THE EARLY TWENTIETH CENTURY revolutionized how we think about physical reality. Before that time, all descriptions of matter had been deterministic—the present completely determining the future. Quantum mechanics changed that. This new theory suggested that for subatomic particles—electrons, neutrons, and protons—the present does NOT completely determine the future. For example, if you shoot one electron down a path and measure where it lands, a second electron shot down the same path under the same conditions will most likely land in a different place! Several gifted scientists, such as Albert Einstein, Niels Bohr, Louis de Broglie, Max Planck, Werner Heisenberg, P. A. M. Dirac, and Erwin Schrödinger, developed quantum-mechanical theory. Their new theory, however, made even some of them uncomfortable. Bohr said, "I should be sorry I ever got involved with quantum theory." Schrödinger wrote, "I don't like it, and I'm sorry I ever had anything to do with it." Albert Einstein disbelieved it stating, "God does not play dice with the universe." In fact, Einstein attempted to disprove quantum mechanics—without success—until he died. Today, quantum mechanics forms the foundation of chemistry—explaining the periodic table and the behavior of the elements in chemical bonding.