CHAPTER 7 LEARNING OBJECTIVES

To satisfy the minimum requirements for this course, you should be able to:

Explain the nature of electromagnetic radiation by:

- describing its wave properties: wavelength (λ), frequency (ν), amplitude, and speed (c)
- performing calculations using the relationship $\lambda\nu = c$ (speed of light)
- describing the relationship between color, energy, and the wavelength of light in the ultraviolet, visible, and infrared regions of the spectrum
- explaining Planck's quantum theory and performing calculations using the equation $E = h\nu$ which gives the energy of a single quantum (photon) of light
- explaining how Einstein accounted for the photoelectric effect

Describe the quantum mechanical model of the atom including:

- the concept of an allowed energy state and how this concept is related to the quantum theory and line spectra
- calculating the energies and wavelengths of light in the hydrogen emission spectrum using Bohr's equation for the energy of the electron, $E = -R_H(1/n^2)$
- the relationships among the following concepts: the wave properties of electrons, Heisenberg's uncertainty principle, orbitals, electron density, and probability
- the meaning of the four quantum numbers (n, l, m_l, m_s) used to describe atomic orbitals and electron spin
- recognizing the shapes of the *s, p,* and *d* orbitals

Discuss how quantum mechanics can be used to explain the arrangement of electrons in an atom and the magnetic properties of atoms and molecules. Specifically:

- give the number and types of orbitals within each shell and subshell
- explain how and why the energy of an orbital depends on its values of n and l
- use the building-up principle, the Pauli exclusion principle, and Hund's rule to write the ground state electron configuration and orbital diagram for any element
- discuss what is meant by the *s, p, d,* and *f* blocks of elements in the periodic table
- use orbital diagrams to predict whether an atom is diamagnetic or paramagnetic