Chapter 2
Atoms, Molecules, and Ions
Learning Objectives

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

1. Understand the organization of the periodic table and be able to:
   - define group (or family) and period
   - identify the following groups: 1A (alkali metals); 2A (alkaline earth metals);
     7A (halogens); 8A (noble gases)
   - identify an element as a metal, nonmetal, or metalloid
   - write the symbol and charge for an atom or ion, having been given the number of protons and electrons, and perform the reverse operation
   - write the symbol for an isotope given its atomic number and mass number

2. Understand how molecular and empirical formulas are used to convey chemical information and be able to:
   - explain the differences between molecular compounds and ionic compounds
   - explain the differences between molecular formulas and empirical formulas
   - write the empirical formula for an ionic compound given the charges of its components

3. Explain how chemicals are systematically named and learn:
   - the names and formulas of the common cations, anions and common acids and bases listed in the General Chemistry Reference Sheet
   - how to name ionic compounds, binary molecular compounds, and ionic compounds containing transition metals

4. Perform calculations involving the masses of atoms and molecules. Examples include:
   - calculate atomic weight from isotope abundance, and vice versa
   - calculate the molecular mass or formula mass (in amu) and molar mass (in g/mol) of a substance from its chemical formula
   - interconvert number of molecules, number of moles, and mass of a substance
   - determine the percent composition by mass of its component elements given the molecular or empirical formula of a compound
   - determine the empirical formula for a compound given its percent composition by mass
   - determine the molecular formula of a compound given its empirical formula and molecular weight

5. NavApp: Boiler water
   - describe the function of a boiler
   - name the phosphates that are used in the treatment of boiler water: Na₂HPO₄, Na₃PO₄
   - name selected compounds that make up sludge and boiler scale, such as MgO, CaO, P₂O₅, CuO, NiO